SCIENCE

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THE SECOND INTERNATIONAL CONVENTION OF THE INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE, LONDON, 1910[1]

BEFORE giving an account of the second International Convention of the International Catalogue of Scientific Literature it will be necessary to briefly review the history of the enterprise and outline its organization. Secretary Henry, of the Smithsonian Institution in 1855, suggested and attempted to establish a Catalogue of Scientific Literature through international cooperation; his efforts, however, were not successful and it was not until the beginning of the publication of the Catalogue of Scientific Papers by the Royal Society in 1882 that his idea was even partly carried into effect. This catalogue continued until 1894 when the Royal Society realized that the task was impossible for any one society or indeed for any one nation to undertake. The Royal Society then through the British Foreign Office called the attention of the governments of the world to the great need of a catalogue of current scientific publications, with the result that an international conference was held in London in 1896 to which twenty-three governments sent delegates, the United States being represented by Dr. John S. Billings and Professor Simon Newcomb. This conference decided that it was both necessary and desirable to begin the publication of a catalogue of scientific literature. Various committees were appointed to consider the numerous questions involved, and a general plan of organization was outlined. A second con-

[1] Read at the general meeting of the American Philosophical Society, Philadelphia, April 20, 1911.

ference was held in London in 1898, Dr. Cyrus Adler, of the Smithsonian Institution representing the United States; and a third conference met in 1900. The various plans formulated at these conferences were definitely agreed to and drafts of schedules of classification, the heart of the whole system, were compiled. The organization is briefly this: all the principal countries of the world, at present numbering thirty-two, undertake to prepare at their own expense a classified index of the current scientific papers published within their domain and to forward the data to a central bureau in London where it is assembled and published in seventeen annual volumes, one for each of the following named subjects: Mathematics, mechanics, physics, chemistry, astronomy, meteorology, mineralogy, geology, physical geography, paleontology, general biology, botany, zoology, human anatomy, anthropology, physiology and bacteriology. The cost of maintaining the central bureau and of printing the catalogue is defrayed entirely by funds received from the subscribers to the work. The regional bureaus are, as a rule, maintained by direct governmental grants. The work began with an index of the literature for the year 1901. Supreme control of the catalogue is vested in a body known as the international convention which met in 1905, in 1910, thereafter to meet every ten years. This paper is for the purpose of giving an outline of the proceedings of the second convention held in London July 12 and 13, 1910. The event was looked forward to with much interest as the enterprise would then have passed through its formative period and the reports would show to what extent it had become a success. All of the principal countries of the world sent delegates as follows:

Austria, Dr. Josef Donabaum (vice-director of the Imperial Royal Court Library, Vienna); *Belgium,* Mons. H. La Fontaine (director of the International Office of Bibliography, Brussels) and Mons. Paul Otlet (secretary-general of the International Office of Bibliography, Brussels); *Denmark,* Dr. Martin Knudsen (Copenhagen); *France,* Dr. J. Deniker (librarian of the Museum of Natural History, Paris); *Germany,* Professor O. Uhlworm (director of the German Regional Bureau); *Holland,* Professor D. J. Korteweg (University of Amsterdam); *India,* Lt.-Col. D. Prain, F. R. S. (director of the Royal Botanic Gardens, Kew) and Mr. L. H. Burkill; *Italy,* Professor R. Nasini (University of Pisa) and Cav. E. Mancini (Academy of Sciences, Rome); *Japan,* Professor Joji Sakurai (University of Tokyo); *New South Wales,* Professor A. Liversidge, F. R. S.; *Russia,* Mons. E. Heintz (scientific secretary of the Central Physical Observatory, St. Petersburg); *South Australia,* Hon. A. A. Kirkpatrick (agent-general for South Australia); *Sweden,* Dr. Aksel Andersson (first librarian of the Royal University Library of Uppsala); *United Kingdom,* Sir Archibald Geikie, president Royal Society, Sir Joseph Larmor, secretary Royal Society, and Professor H. E. Armstrong, F. R. S.; *United States,* Leonard C. Gunnell (United States Regional Bureau, Smithsonian Institution).

Mr. A. B. Kempe, treasurer of the Royal Society and Dr. P. Chalmers Mitchell, member of the Executive Committee, were invited to take part in the convention as was also Dr. H. Forster Morley, who has since the beginning of the enterprise acted as director of the London Central Bureau.

At the opening meeting held in the rooms of the Royal Society on July 12, Sir Archibald Geikie, president of the Royal Society, was elected chairman and Professor Henry E. Armstrong, fellow of the Royal Society, vice-chairman. Professor

Armstrong is the Nestor of the enterprise and from the beginning of the work has been one of the members of the International Council and chairman of the executive committee. Secretaries for the official languages of the catalogue—French, German, Italian and English—were then appointed. After an address of welcome by Sir Archibald Geikie and the announcement of a number of hospitable invitations to the delegates, the report of the executive committee was laid before the convention. This report formed the basis of most of the discussions that followed and to save repetition its contents will be referred to or quoted in full while reporting the proceedings of the convention.

The report stated that the seven annual issues already published had cost the central bureau $257,980, for which $246,410 had been received. The size of the first four annual issues had averaged 8,441 pages each, the fifth and sixth issues averaged 10,417 each, the seventh issue contained 9,219 pages. The enlargement of the fifth and sixth issues was due to the fact that the various bureaus owing to improved methods had begun indexing journals not previously included in the work. When the International Council met in June, 1909, it was decided to use modified titles in the subject index with the result that the seventh issue showed a marked decrease in size and it was estimated that the eighth issue would show an even greater reduction. In 1900 it was estimated that the gross income would be $27,500 which it was thought would cover the cost of an edition of 500 copies if each issue comprised not more than 160,000 entries. The annual income has been $35,000 while the cost has been $36,855. The increased cost was due to the increased size of the catalogue and also to the fact that a thousand copies instead of five hundred had been printed. The working capital needed was larger than originally estimated amounting to a total of $37,500 advanced by the Royal Society on all of which interest is paid. It was stated that if the steps already taken were continued the deficit could probably be cancelled, and if the first ten issues could thus be published without loss that in consideration of the extent and difficulty of the enterprise the result would be most satisfactory. Foundations having thus been laid for an international organization of great importance and influence it was thought essential that steps be taken to make the existence of the organization better known and its powers of usefulness more fully appreciated.

A general discussion of methods looking to reduction of expense then followed taking up among other questions the comparative cost of printing in England and other countries. This led to a discussion of the finances of the whole enterprise and the result of the debate may be summed up as follows:

That it was necessary to reduce the size of the printed volumes without limiting their usefulness which might be accomplished by revising somewhat the classification schedules so as to reduce the number of cross references and also by abbreviating the references in the subject catalogue. Emphasis was laid upon the desirability of consolidating the International Catalogue with other bodies engaged in the preparation of bibliographies of scientific works, thus following a precedent established in 1905 when the Zoological Society of London agreed to cooperate with the International Catalogue in the preparation and publication of the *Zoological Record*. Dr. Chalmers Mitchell, secretary of the Zoological Society, on being asked by Sir Archibald Geikie what the saving of expense had been by this fusion of in-

terests replied that the *Zoological Record* when published by the Zoological Society did not pay at all, for it had been prepared by a few zealous specialists who were content with a very small remuneration and the Zoological Society had been willing to bear the expense. When the two works were combined in 1905 the Zoological Society did not attempt to reduce the total cost of the *Record* but in fact increased the rate of pay to the compilers. He stated that for many reasons it was quite necessary that the fusion should take place, that the combined volume was very much better than the separate publications had been, and that it would have been impossible to keep the *Record* going but for the fusion that had taken place. The advantage of amalgamation lay rather in the concentration of effort than in financial saving. Sir Archibald Geikie asked if there had been any real difficulties in the combined arrangement, thinking that the fusion was an example of what might be done with other societies. As Professor Armstrong and Dr. Chalmers Mitchell had been the means of bringing about the consolidation, Dr. Chalmers Mitchell's answer is significant. He said:

> The fusion has taken place, and Professor Armstrong I think will corroborate me in this; we who know the immense difficulties at every stage, know quite well that if the *Zoological Record* could be fused with the International Catalogue Record, then it must be a very easy task to fuse any two other records.

The following resolution was then discussed and agreed to.

> *Resolved,* That in view of the success already achieved by the International Catalogue of Scientific Literature and the great importance of the objects promoted by it, it is imperative to continue the publication of the Catalogue at least during the period 1911–15 and on recommendation of the International Council during the subsequent five years 1916–20.

Following this it was

> *Resolved,* That in view of the resolution arrived at to continue the Catalogue for a further period of five years the Royal Society of London be requested to act as in the past as the publishing body and to make the necessary contracts.

Dr. Forster Morley was reappointed director of the catalogue and the international convention was authorized to spend annually the sum of $10,000, in addition to the director's salary, for the purpose of carrying on the work of the central bureau.

It was then unanimously voted "that it is most desirable that a capital fund should be obtained for the catalogue." It is now apparent that the lack of a capital fund has been the stumbling-block of the undertaking from the beginning. Not only has it been necessary to borrow money on which interest must be paid but lack of sufficient income has rendered it impossible to carry out several plans looking to the general improvement of the work. Had a capital fund been established in the beginning of the enterprise it would not have been necessary for the subscription price to have been placed at such a high figure, consequently, a larger subscription list could have been expected and a larger edition published at a lower rate to each subscriber. No commercial enterprise can exist without sufficient capital and the publication of a great work such as the International Catalogue should not be considered in any other light than as a business enterprise if it is to be regularly continued. The subscription cost is $85 per year and experience has shown that if the list could be doubled the cost could be cut almost in half, and if the number of subscribers could be quadrupled a still further reduction in price would be possible. A relatively small endowment yielding an annual income of not more than ten thousand dollars to be placed at the disposal of the cen-

tral bureau would render it possible to make many improvements and also to broaden the scope of the catalogue. The sum needed is so small in comparison with the good that could be accomplished that it would be strange indeed if in these days of large endowments some individual can not be found willing to provide the necessary funds. As the idea of the International Catalogue originated in the United States the writer is encouraged to hope that some American will further add to the credit already given to this country by endowing the now organized body with a sufficient fund to properly carry on and extend the work.

At the session of the convention on July 13 methods of administration likely to come before the International Council and the executive committee before the next meeting of the International Convention in 1920 were discussed. Professor Armstrong emphasized the great need of confining the catalogue to references to original contributions to scientific knowledge and of the desirability of constantly consulting specialists in the several sciences regarding the proper classification of the papers indexed. It was thought that the organization could now claim some measure of authority in dealing with questions connected with the bibliography of science and thus bring about greater uniformity in practise. On account of the almost insurmountable difficulties in dealing with the present vast number of journals included in the work of the catalogue it was agreed that a revised list of journals should be prepared to contain only those of recognized scientific importance and that the regional bureaus should agree to index all scientific papers published in these journals early in the year following their publication. The International Catalogue could thus within the year following the appearance of a paper publish a full index of its contents. After much discussion this subject was embodied in the following resolution which was unanimously adopted.

Resolved, That each regional bureau be requested to prepare a list of journals in each science which the Catalogue will completely index in the annual issue following the year of publication and that the central bureau be authorized to publish the lists thus prepared.

The publication of this list does not mean that no other journals are to be considered but the list will consist essentially of journals devoted almost exclusively to scientific matters and these journals will therefore be given precedence in the work of the regional bureaus.

To make it possible to carry out this plan to promptly publish future volumes of the catalogue the following resolution was adopted:

That the resolution of the year 1900 authorizing the central bureau to close these volumes at different stated dates, each volume to correspond to the literature of a period of twelve months, be confirmed.

The effect of this resolution will be that the separate volumes of the catalogue will not necessarily cover a whole calendar year but will cover a period of twelve months.

Reference was made in the report of the executive committee to a proposed international scheme for the publication of yearly tables of physical-chemical constants and in this connection a communication from Sir William Ramsay was read written in consequence of a resolution passed at the International Association of Academies in Rome to whom an application for patronage had been sent. In the report of the executive committee it was pointed out that this work had been embraced in the original plan for the catalogue and though it was one of great difficulty it was still the intention to publish such tables in connec-

tion with the International Catalogue. It was thereupon voted:

That it be referred to the executive committee, after consultation with the regional bureaus, to consider and decide as to what steps, if any, can be taken for cooperation with the proposed International Commission for the publication of annual Physical Chemical Tables.

The two following resolutions were then agreed to and as each was presented a general discussion of its merits followed. The final decision of the matter can not be better expressed than by quoting the resolutions in full.

The first was,

Resolved, That a committee be appointed to revise the schedules and to make such other alterations as may be necessary in the form of issue of the Catalogue. That it be an instruction to the committee that, so far as possible, the subject index be confined to abbreviated titles and authors' names and numbers to serve as references to the author index. That it be an instruction to the regional bureaus to have in mind constantly the need of maintaining the Catalogue of minimum bulk. That the committee consist of the executive committee and Dr. Deniker, Dr. Heintz and Professor Korteweg.

The executive committee being Professor H. E. Armstrong, Dr. Horace T. Brown, Professor A. Famintzin, Leonard C. Gunnell, Professor H. McLeod, Dr. P. Chalmers Mitchell, Professor R. Nasini, Professor H. Poincaré, Professor O. Uhlworm.

The second resolution was,

That in view of the resolution adopted unanimously by the representatives of the various countries constituting the convention, desiring the Royal Society to continue its responsibility for the publication of the International Catalogue for a further period, the committee appointed be instructed: (1) To take all possible steps to prevent reduplication by the publication of several annual and similar catalogues and indexes on the same subject, by making arrangements such as those now in force with the Zoological Society of London. (2) To obtain further assistance and cooperation in the preparation of the material of the Catalogue from the principal scientific societies and academies and the organizations which collect materials for indexing scientific literature.

The question of the publication of a decennial index referred to in the report of the executive committee was discussed and it was decided that on account of the financial difficulties involved unless the sales of the catalogue increased to a considerable extent the publication of the decennial index could not for the present be entertained. The matter was left for the action of the next meeting of the International Council which would be held within the next two years.

However short the time allotted for this subject may be an account would be incomplete without some mention of the numerous and gracious hospitalities extended to the foreign delegates by the Royal Society, the Royal Society Club and individually by the English members of the convention who lost no opportunity to show their guests every possible courtesy and consideration.

Leonard C. Gunnell
Smithsonian Institution,
April 13, 1911

Some Prussian Educational Data

A mine of statistical information concerning educational conditions in Prussia is Kunze's "Kalendar für das höhere Schulwesen Preussens" (Trewendt und Granier, Breslau), which has been issued annually for seventeen years. The 1910 edition has just made its appearance, and the German press is busy rearranging its data and forming conclusions. The interest which Americans in general show in German education warrants some discussion of its information with regard to Prussian secondary schools.

The steady growth in the population of the country is of course accompanied by an increase in the number of secondary schools. In 1900 there were in Prussia, in all, 564

Gymnasien (classical schools) and *Realschulen* (schools with French and English instead of the ancient languages); there are now 725. The city institutions have multiplied more rapidly than those supported by the state. There are now 474 city higher schools as against 251 state schools. In 1900 the figures were 344 and 220. The schools are not increasing in number as rapidly as a few years ago. In 1907, 26 new ones were established, in 1908, 22; in 1909, 12; in 1910, 14.

The practical trend of opinion which instituted the *Realschulen* is still making itself felt. In 1900 there were still 341 *Gymnasien* as against 223 *Realschulen*. Now there are 364 of the former and 361 of the latter. The extreme *Realschule*, however, which offers no Latin at all, is not gaining ground as rapidly as the compromise schools. In 1900 there were 85 *Realgymnasien*, with 138 *Realschulen* and *Oberrealschulen*. Now there are 161 of the former to match 200 of the latter. Here is a faint evidence of reaction against the ultra-practical educational theories of the century's beginning. The *Reformgymnasien*, which begin with a modern language—in all but two cases with French,—in *Sexta* (the lowest of the nine classes) and with Latin in *Untertertia* (the fourth class from the beginning), are increasing in popularity. There are now 110 of them. The *Reformrealgymnasium* in Geestemünde and the one in Osnabrück begin with English instead of French. The regulation *Realschule* offers nine years of French and six of English. There seems no reason for this arrangement except the inertia of French influence. It might be contended that the cultural importance of French warrants great attention to it in the old-line schools: but one would scarcely expect such a reason to have much weight with the ultra-practical *Realschulen*.

The line between *Gymnasium* and *Realschule* is not always one of absolute separation. There are numerous *Doppelanstalten*, in which a *Gymnasium* is joined to a *Realgymnasium* or a *Realschule*, and several in which a *Realgymnasium* and a *Realschule* are combined. Some of the regular *Gymnasien* allow students who do not wish to study Greek to substitute a modern language, and there are some instances where *Realgymnasien* and *Realschulen* offer Greek as an elective.

The German secondary schools have never been excessively large. In 1900 there were 60 which had more than 500 students each; in 1910 there are 136. In the former year the Royal Pauline *Gymnasium* in Münster-in-Westphalen and the Guerickeschule in Magdeburg (which was then a *Realschule* and *Realgymnasium* combined), counted 840 scholars each and headed the list. The Guerickeschule lost its *Realgymnasium* and its numerically commanding position, and the school in Münster ceased to grow. The largest Prussian institution is now the city *Gymnasium* and *Realschule* in Mülheim, with 948 boys. If we add the 157 children in the *Vorschule* or preparatory school, who recite in the same building and are under the control of the same director, the school numbers 1,100. The Mülheim school has an average of 31.6 students in a class; its present rival in size, the Royal Berger-Oberrealschule in Posen, with 896 students, has 44.8 in a class.

In 1900 these schools employed 6,860 teachers. In 1910 there are 10,150. The number of officially qualified candidates for these positions decreased considerably during the last decade. In 1895 the number on the waiting list had reached its maximum—1,472. In 1900 it had fallen to 693, and in 1906 to 124. In 1897 there were only 73 unfilled positions in the system. By 1900 the number had increased to 127, and seven years later high-water mark was reached, with 384 vacant places. In the last few years qualified candidates have grown more numerous again. There are now 384, as against 124 in 1906.

Prussian secondary school teachers are generally required to teach two or more subjects. It is interesting to note the equipment of the candidates. One hundred twenty-three are prepared to teach religion and Hebrew, 522 for Latin and Greek, 475 for French and English, 482 for mathematics and physics, 155 for chemistry and natural science, 554 for history and geography, 448 for German, 243 for ath-

letics. Last year's list stood, for the same subjects in the same order, 128, 391, 441, 452, 139, 406, 364, 195. History thus shows the greatest advance, and it is a little surprising to find Latin and Greek coming next. Least popular is religion, and there may be a connection between this fact and the wide-spread criticism of the status of religious instruction in the German schools.

New openings in these schools are not appearing as rapidly as was the case a few years ago. For the last four years the numbers are 355, 323, 286 and 222. Thus the new positions created in 1910 were 133 fewer than in 1907.

The higher schools for girls are, as was to be expected, growing much more rapidly, even though the feminist movement has not taken hold of Germany as vigorously as it has seized some other countries. In 1900 Prussia and her cities were maintaining 104 girls' secondary schools. Last year the number had reached 188, and it is now 225. It will be seen that the rapid increase in the number of these schools is a very recent affair. Twelve of the girls' schools are in charge of lady directors.

There are fifteen regular German secondary schools in other countries, located in Antwerp, Barcelona, Brussels, Belgrano near Buenos-Ayres, Buenos-Ayres itself, Bukharest, Cairo, Constantinople, Genoa, Madrid, Milan, Mexico, Rio de Janeiro, Rome and Tsingtau. Twenty-nine directors and instructors with regular positions in Prussia are at work for the year as exchange teachers or lecturers in other countries.

Roy Temple House

EDWIN E. HOWELL

On Easter Sunday Edwin Eugene Howell died at his home in Washington. Geologists, physiographers and educators of our country thereby lost an efficient and appreciated ally.

In the year 1861 the late Henry A. Ward, then professor of geology in the University of Rochester, erected on the college campus a building which he called Cosmos Hall and which was devoted to the assemblage and preparation of scientific material for museums of natural history. The establishment thus instituted grew and developed, and it still flourishes. Its work was performed largely by young men of congenial tastes, who there acquired the practical experience which commended them later to the trustees of larger responsibilities. It thus served incidentally as a training school in the natural sciences and especially in certain branches connected with museums. Among its graduates are Frederic A. Lucas, curator in chief of the Brooklyn Institute Museums; William T. Hornaday, director of the New York Zoological Park; F. C. Baker, curator of the Chicago Academy of Sciences; William M. Wheeler, professor of economic entomology at Harvard University; and Henry L. Ward, director of the Milwaukee Public Museum; and in addition to these the writer, who ranks himself somewhat proudly as senior alumnus. This was Howell's school, his real school despite the fact that the biographies mention only the country schools of his native county and the University of Rochester, which recognized certain special studies by making him a master of arts. He entered it in 1865, at the age of 21, and took his diploma—so to speak—in 1872.

For two years he was a geologist of the Wheeler Survey and then for a year held a similar position in the Powell Survey, his work consisting of geologic reconnaissance in Utah, Nevada, Arizona and New Mexico. Then, having become satisfied that this occupation was not the one for which he was best fitted, he resigned his position and returned to the Rochester Museum, becoming a partner where he had before been an assistant. A few years later he removed to Washington, where he established "The Microcosm," an institution somewhat similar to Ward's Cosmos Hall but devoted more particularly to geologic material and subjects. The modeling of relief maps, in which work he was a pioneer—if not *the* pioneer—for the United States, soon became a specialty; and his monument, for a generation at least, will consist in the plastic representations of physiography, topography and geologic structure which adorn the halls

and walls of museums and schoolrooms throughout the continent.

He was one of the founders of the Geological Society of America and was connected with a number of other scientific associations, national and local, but he rarely contributed to their discussions. Besides the report on his geologic field work, his contributions to scientific literature included only brief descriptions of meteorites.

Personally Howell was quiet, unassuming and sincere. His recognized integrity was an important factor in his business success. If he had enemies or detractors I have not met them. His modeling was not distinguished by its artistic quality, but was realistic whenever the material from which he worked was full. His clients found him ever clamorous for facts and anxious to revise work at any stage if it could thus be made more truthful, and his clients, who were numerous among the investigators and teachers of geology and geography, were also his friends.

He was born March 12, 1845, in Genesee County, N. Y., and passed his boyhood on a farm. In 1880 he married Annie H. Williams, an artist. His wife died in 1893, but a son and daughter survive him.

G. K. GILBERT

HERMAN KNAPP

THE scant space given in the press to the death of Dr. Herman Knapp is but another proof that we have not come to place that value upon great scientists which is characteristic of older countries. Had he lived in Berlin or Paris the passing of Dr. Knapp would have been one of the great topics of the day, for his was a life of singular usefulness to the community, as well as to the science of ophthalmology, and there were few American medical men who rejoiced in wider renown on the other side of the water than did he. He studied at no less than seven European universities. He established a dispensary and hospital for eye diseases which is now a part of the University of Heidelberg, at which he taught for four years. Settling in this city in 1868, he became at once the foremost practitioner in ophthalmic and aural diseases and the founder of the Ophthalmic and Aural Institute, besides being a professor in the College of Physicians and Surgeons. But this is the briefest outline of an enormously busy and useful life. Never was there a doctor in New York who gave more generously of his services to the poor and the needy; to them he would go even late at night after an exhausting day's labor, if no other time was available. More than that, the whole science of medicine is in his debt for the Archives of Ophthalmology and Otology which he founded, as well as for numerous treatises and text-books of permanent value and for his lasting contributions to the treatment of eye diseases.—N. Y. *Evening Post.*

SCIENTIFIC NOTES AND NEWS

DR. FREDERIC A. LUCAS, curator in chief of the Museum of the Brooklyn Institute, and formerly curator of the U. S. National Museum, has been elected director of the American Museum of Natural History.

DR. LEWIS BOSS, director of the Dudley Observatory, Albany, has been elected a corresponding member of the St. Petersburg Academy of Sciences.

PROFESSOR EDWARD L. MARK, director of the Harvard Zoological Laboratory, has been elected a foreign member of the Bohemian Academy of Sciences.

DR. E. B. WILSON has been designated Da Costa professor of zoology in Columbia University, succeeding in this chair Professor Henry F. Osborn, who becomes research professor of zoology.

THE Edward Kempton Adams research fellowship has been awarded by Columbia University to Dr. R. W. Wood, professor of experimental physics at the Johns Hopkins University.

A PORTRAIT of Professor John Cleland, who from 1877 to 1909 occupied the chair of anatomy at Glasgow, was presented to the university on April 26 and a copy to Mrs. Cleland. Before the presentations the senate met and conferred on Professor Cleland the honorary degree of LL.D.

Dr. Alfred Tozzer, of Harvard University, has been made a corresponding member of the Société des Américanistes de Paris.

President Taft has designated Secretary of Commerce and Labor Nagel and Mr. Chandler P. Anderson, counsellor of the State Department, to confer with representatives of Great Britain, Japan and Russia and to negotiate a treaty for the protection of seals and other mammals in the North Pacific Ocean.

Dr. Issa Tanimura, an honorary fellow in the College of Agriculture of Cornell University, has been appointed by the government of Japan a special commissioner of agriculture to investigate the live-stock industry in this country.

Mr. C. H. T. Townsend has accepted an extension of contract from the Peruvian government, as entomologist of state, to December 31, 1912, and expects to conduct extended parasite work against cotton insects, especially the white scale and the square weevil. A laboratory will be established at Piura, in northern Peru, for the accommodation of the work, and a corps of assistants will be provided.

Dr. L. J. Cole, professor of experimental breeding at the University of Wisconsin, will leave on May 6 for a summer's work in western Europe. His trip will include an inspection tour of all the experiment stations and agricultural colleges.

Professor C. C. Thomas, of the engineering school of the University of Wisconsin, has been appointed the university's delegate to the one hundredth anniversary of the foundation of the University of Breslau, which will be held from August 1 to 3, 1911.

Leave of absence has been granted by the board of trustees of Worcester Polytechnic Institute to Professor Harold B. Smith for a period of two years. About one year will be spent in travel. The second year will be spent in special resident study at Berlin and Zurich, and in the investigation of as many European educational institutions as possible. This leave of absence follows fifteen consecutive years of active work on the part of Professor Smith as head of the electrical engineering department of the institute.

During the Easter recess Professors Gilbert van Ingen and William J. Sinclair led an expedition of Princeton students to Yorktown, Va., for field work on the Miocene formation at that place.

Professor Svante Arrhenius, delivered three lectures at Harvard University on April 25 and 28 and May 1. The titles were "The Mutual Relations of the Exact Sciences"; "The Theory of Electrolytic Dissociation," and "Adsorption." A dinner in his honor was given by members of the scientific departments at Harvard on May 3.

Professor E. F. McCampbell, of the department of bacteriology of the Ohio State University, delivered the annual chapter lecture of the Sigma Xi society of that institution on Wednesday evening, April 26, on the subject, "The Poisonous Secretions of Animals."

Dr. George T. Moore, of Washington University, delivered the Sigma Xi address at the University of Missouri on "Modern Botany, its Development and Application."

Lady Kelvin has made a gift of £500 to the University of Glasgow for a prize in memory of the late Lord Kelvin. The prize, which will be accompanied by a gold medal, will be awarded once in three years to a doctor of science whose dissertation contains evidence of distinguished original experimental work.

The freedom of the City of London has been conferred 178 times since the year 1757, the recipients including four scientific men: Edward Jenner, Sir George Arey, Sir Henry Bessemer and Lord Lister.

Dr. Herman Knapp, professor emeritus of ophthalmology in Columbia University, eminent for his contributions to this subject, died on April 30, in his eightieth year.

Dr. Pehr Olsson-Seffer, born in Finland in 1873, formerly instructor in botany at Stanford University, and recently director of the Tezonapa Botanical Station and botanist of the Mexican government, has been murdered by brigands in the Mexican insurrection.

DR. CAMERON PIGGOTTY, professor of chemistry in the University of South, died on April 30, aged fifty-five years.

MR. HENRY SCHERREN, an English writer on zoological subjects, died on April 25.

THE death is announced of M. Henri Berge, professor of chemistry at the University of Brussels.

THE U. S. Civil Service Commission announces an examination on June 7, to fill one or more vacancies in the position of botanical translator, at $1,400 or $1,500 per annum, in the Bureau of Plant Industry, Department of Agriculture.

THE forty-fourth annual meeting of the Canadian Medical Association will be held at Montreal in the first week of June, immediately after the official opening of the new medical buildings of McGill University.

Nature states that an important discovery in regard to the existence of man in early Pleistocene or Pliocene strata has been made by the Marquis of Cerralbo in Spain. In the alluvial deposits of the River Jalon, which is an affluent of the Guadalquiver, he has discovered very abundant remains of undoubted *Elephas meridionalis* in contact with well-characterized implements of human workmanship of the proto-Chellean type. Photographs of the specimens and of the cuttings in which they occur have been received from the marquis in Paris, and Professor Marcelin Boule left Paris in Easter week in order to examine the site and the specimens. It is possible that *E. meridionalis* may have survived in the south of Europe from Pliocene into early Pleistocene times, but the association of implements of human workmanship with this early species of elephant is altogether new.

OFFICERS of a number of the leading colleges and universities charged with the business administration, met at Yale University on April 27. The following subjects were proposed for discussion:

Methods of increasing graduate financial interest in university endowment.

The problem of the investment of trust funds—whether to apply each investment to a specific fund, or to invest the funds collectively.

Dormitories—their construction, management and the income to be expected from them.

What constitutes adequate fire, liability and casualty insurance?

Budget and appropriation systems.

The requirement of bonds from students for the payment of college bills.

Infirmary administration and sanitary inspection.

Pensions for employees and the general question of "welfare work" for employees.

The problem of the dining hall.

The establishment of central stations for heat, light and power.

Consideration of the Carnegie report on "Academic and Industrial Efficiency."

Cooperative purchasing by universities.

Should students who can afford it pay the full cost of tuition voluntarily?—about 40 per cent. of the cost of education now being paid by the student.

"Functional" administration versus "departmental" administration.

"Centralized administrative responsibility" versus "committee government."

THE eighth annual session of the Puget Sound Marine Station at Friday Harbor, in the state of Washington, will begin on Monday, June 26, and continue for six weeks, closing on August 5. The laboratory will be under the general charge of Professor Trevor Kincaid, of the University of Washington, assisted by a council representing the several institutions participating in the organization. The instructors with the courses they offer will be as follows: *Ecology,* Trevor Kincaid, University of Washington; *Comparative Embryology,* W. J. Baumgartner, University of Kansas; *Plankton,* John F. Bovard, University of Oregon; *General Zoology,* H. B. Duncanson, State Normal School, Peru, Nebraska; *Algæ,* Geo. B. Rigg, University of Washington; *Phanerogamic Botany,* A. R. Sweetser, University of Oregon. The work of the station entered upon a new phase during the session of 1910, when a substantially constructed three story laboratory was put into commission, provided with running salt and fresh water, electric light, aquarium tanks, etc. An addi-

tional building is now under construction. The equipment has been greatly improved through provision for more thorough deep-water dredging operations. Exceptionally fine opportunities are presented for the collection of class material as well as for systematic and ecological study. Information in regard to the station will be supplied by the director, Trevor Kincaid, University of Washington, Seattle, Wash.

The following resolution with reference to the chestnut blight disease was presented by Professor John W. Harshberger at the general meeting of the American Philosophical Society and unanimously adopted on April 22, 1911:

Whereas, there has appeared in the eastern United States a destructive fungous disease of the chestnut tree, known as the chestnut blight, which as a disease in epidemic form threatens to destroy the native chestnut throughout North America, be it

Resolved, that the American Philosophical Society in general meeting assembled heartily supports appropriate legislation in Pennsylvania, in other states, or by the national government looking to the eradication of the disease by the establishment of a quarantine, or by other more drastic measures of destroying the diseased trees along the outposts of the infected areas, and be it

Resolved, that the members of the national Congress and the members of the several state legislatures are requested to adopt such legislation, as above mentioned, and appropriate sufficiently large sums of money with the view of stamping out the disease before it reaches the main body of chestnut timber in the southern and southwestern deciduous forests of our country, and it is

Resolved, that the members of the American Philosophical Society will support the movement begun in Pennsylvania looking to the eradication of the disease from our too rapidly disappearing forest areas.

The London correspondent of the *Journal* of the American Medical Association writes that the National League for Physical Education and Improvement has proposed that the London memorial to the late King Edward, whose great interest in sanitary problems is well known, should take the form of a public health museum. In a recent conference of health-promoting institutions, a discussion on the need of coordination disclosed the existence of over eighty such national agencies in London and of a large number of local agencies in London and throughout the country. It was shown that these suffered much both in finance and work from overlapping, from separation of offices and staff and from lack of coordination. The striking success of the tuberculosis exhibition opened in Dublin and then transferred to the Irish Village in the exhibition at London and to other places throughout the country, demonstrated the great interest taken by the public in sanitary questions. It is proposed to erect a popular museum which should accommodate a permanent collection and also furnish duplicate material for the equipment of traveling vans. It should be a model in constant and close relation with provincial museums to which it would probably give birth. It might also become a loan center for the distribution of replicas of its models and diagrams for circulation among schools and institutions. The building should also form a nucleus for the coordination of the various health-promoting institutions, both metropolitan and national. For this purpose, it should include the following: Two or three meeting halls of different sizes, ten or twelve committee rooms, central offices, a library and reading rooms, lecture rooms, workshop and draftsman's room. The cost of maintenance would be met, to some extent, by the rental of suites of offices, halls, committee rooms, especially by health-promoting conferences and institutions, and to some extent by small fees for courses of instruction. In the main, however, instruction must be given at a low cost, fees being charged only when they will guarantee greater interest in those who pay, and being reduced to such a level as will admit of the greatest possible use of the facilities provided. This would be sufficient grounds for appealing for subscriptions to trades unions, friendly societies, insurance companies and the general public. An appeal will be made for a memorial sum of $500,000 and a subscription of $25,000 a

year as a minimum. The early cooperation of organizations of the working classes and of those working for the prevention of tuberculosis and alcoholism will be sought.

THE Weather Bureau has published for many years the *Monthly Weather Review*, treating of the general weather conditions throughout the United States as a whole, with occasional summaries of climatic data from other and frequently little known regions of the earth. Also there have appeared in its pages many scientific and popular contributions from the best students of meteorology and kindred subjects, thus making it one of the leading meteorological and climatological journals of the world. A considerable number of the several monthly and annual issues of this publication have accumulated in the files of the Weather Bureau and it is thought they would be a valuable addition to any library. If any library desires copies of these publications, either for the completion of broken files or as new matter of public interest, copies of such issues as are available will be furnished free of charge upon request.

UNIVERSITY AND EDUCATIONAL NEWS

COLUMBIA UNIVERSITY has received an anonymous gift of $10,000 annually for four years for surgical research, and a gift of $15,000 for five years for the establishment of a bureau to study legislative drafting.

FURMAN UNIVERSITY, the Baptist College of South Carolina, has now in course of construction a $50,000 science building which will accommodate the departments of chemistry, biology and physics with lecture rooms and laboratories. Half the cost of this building was supplied by local contributors and the other half was the gift of Mr. Rockefeller. It is expected that the building will be completed and ready for occupancy at the beginning of the next session, in September.

MISS A. H. CRUICKSHANK, daughter of a former professor of mathematics in Aberdeen University, who during her lifetime made generous gifts to the university, has bequeathed £22,000 for the endowment of a chair of astronomy, the establishment of a science library and the provision of law prizes in the university, and the residue of her estate for kindred objects.

THE Drapers' Company, London, has granted £6,000 to the Battersea Polytechnic for the erection and equipment of a department of hygiene and physiology.

DR. HENRY PIKE, of the University of Chicago, has been appointed assistant professor of physiology and Dr. Warfield T. Longcope, of the University of Pennsylvania, assistant professor of medicine in Columbia University.

AT Cornell University Mr. F. K. Richtmyer has been promoted to be assistant professor of physics; Mr. C. W. Bennett, to be instructor in chemistry, and C. K. Carpenter to be instructor in experimental engineering.

THE following promotions have been made in the department of botany of the University of Chicago: Charles J. Chamberlain, advanced from assistant professor to associate professor; Henry C. Cowles, advanced from assistant professor to associate professor; William J. G. Land, advanced from instructor to assistant professor; William Crocker, advanced from instructor to assistant professor.

DISCUSSION AND CORRESPONDENCE

PHARMACOLOGICAL ACTION OF THE NON-ALCOHOLIC CONSTITUENTS OF ALCOHOLIC BEVERAGES

TO THE EDITOR OF SCIENCE: In a recent number of SCIENCE[1] D. D. Whitney, in an article entitled "The Poisonous Effects of Alcoholic Beverages not Proportional to their Alcoholic Contents," cites the following sentences from my report on the pharmacological action of ethyl alcohol:[2]

> The more concentrated alcoholic liquors or spirits are, from a practical point of view, the

[1] April 14, 1911, p. 587.

[2] "A Critical Review of the Pharmacological Action of Ethyl Alcohol, with a Statement of the Relative Toxicity of the Constituents of Alcoholic Beverages," by John J. Abel, pp. 1–169 in Vol. II., "Physiological Aspects of the Liquor Problem," Boston and New York, Houghton, Mifflin & Co., 1903.

most toxic of all alcoholic beverages. If whiskey or cognac were always to be diluted with water until the percentage of alcohol was brought down to ten per cent., they would be no more toxic than wine of the same strength.

He then remarks:

These statements would lead one to infer that if the alcoholic content of all beverages was reduced to the same percentage, the toxicity of each beverage would be the same. If true, such a conclusion would greatly simplify the method of determining the relative harmfulness of the many kinds of alcoholic beverages.

It is easy to give a wrong impression by use of sentences removed from their context. Statements that precede and follow may be absolutely necessary to convey an author's true meaning. Had Whitney included the whole of the paragraph whose beginning he quotes, he could not have drawn an inference which gives an incorrect impression of my report. The rest of the paragraph is as follows:

In fact, a number of French authorities maintain that the finest wines are, in proportion to the amount of alcohol contained in them, more toxic than the brandies. The question of the relative toxicity of the various constituents of alcoholic beverages has been narrowed down to a study of the action of the higher alcohols, the ethers and aldehydes as compared with that of ethyl alcohol. This point of view is justified for the stronger beverages, such as the liqueurs, brandy, rum, whiskey, etc., and the stronger wines. As we have seen, however, a study of the misuse of beer would have also to take account of other factors. As these factors have not yet been made the subject of special study, we shall confine ourselves to the by-products found in spirits and wines.

Numerous other passages could be cited to show that the word "all" has no place in Whitney's inference. On page 23 of the report may be read:

The liquor sold in France under the name of absinthe contains all the way from forty-seven to eighty per cent. of ethyl alcohol and is highly flavored with the aromatic constituents of wormwood, anise, fennel, coriander, calamus aromaticus, hyssop, marjoram, etc., the proportion and selection of these flavors varying with the special variety of the absinthe. As long ago as 1865 Lancereux maintained that alcohol is, from a quantitative point of view, the chief poison of absinthe. Yet there can be no doubt that if the alcohol were removed from absinthe, its excessive consumption would still wreck the nervous system, because of the presence in large amount of the aromatic constituents enumerated.

My report had to deal principally with the effect of the various constituents of alcoholic beverages on the higher animals and man, since the work of the Committee of Fifty concerned itself with the problem of intemperance. The experiments of investigators on the action of the higher alcohols, esters, aldehydes and other by-products of alcoholic beverages were given, as also tables showing the relative killing power of these constituents for higher animals and statements in regard to what was known of their action in chronic alcoholism.

From all these studies it was concluded that ethyl alcohol is the *preponderatingly harmful ingredient of alcoholic beverages,* and poisonous enough to account for all the evils of intemperance, an ingredient compared with which the small quantities of higher alcohols, aldehydes, etc., associated with it in alcoholic beverages may be neglected by those who seek to reform these evils. Nevertheless the report furnishes abundant proof that the action of the various by-products or non-alcoholic constituents of these beverages were duly considered so far as the data at hand at that time (1899–1900) were applicable to man and the higher animals. In the section of the report dealing with the subject of chronic alcoholism passages like the following may be read:

The two examples that have been cited show how necessary it is to study the behavior of *each*[3] of the by-products in alcoholic drinks when administered by itself over a long period before we can attribute to each its own share of the harmfulness which ensues from the prolonged and excessive use of spirits, wines, etc. It is not enough to know the toxic equivalent of an alcohol or of a by-product as measured by the experiments detailed in the preceding section in order to deter-

[3] Italics as in the original.

mine precisely what effects will follow their prolonged administration. But experiments on animals involving the daily and prolonged administration of small quantities of *each* of the several higher alcohols which are found to exist in traces in distilled liquors are not as numerous as could be desired.

Again in speaking of alcohol as a respiratory stimulant, p. 116, it is stated that highly flavored wines, brandy and other alcoholic beverages which contain larger amounts of stimulating esters have a more pronounced action than ethyl alcohol and in numerous passages elsewhere throughout the book it will be found that the pharmacological action of ethyl alcohol is contrasted with that of the by-products of alcoholic beverages. On p. 10 may be read: "In 'pure' wines the various ethers and aldehydes constituting the 'bouquet,' the degree of acidity, the amount of sugar and salts, are of importance, both from a medical and from a hygienic point of view."

A report which aims to show that ethyl alcohol is the chief deleterious agent of alcoholic beverages and the one mainly responsible for the evils of intemperance should not be so quoted that one could infer that it was there stated or implied that the effects of *all such beverages on all living things (including rotifers) is to be measured only by their alcoholic content.*

JOHN J. ABEL

BALTIMORE,
April 19, 1911

THE APPOINTMENT, PROMOTION AND REMOVAL OF OFFICERS OF INSTRUCTION

THE address by President Van Hise, "The Appointment and Tenure of University Professors," which was printed in SCIENCE on February 17, 1911, is interesting in many ways. It shows, in the first place, the prevalence of a strong feeling that there is something unsatisfactory about the way in which the power of appointment and removal is exercised in our universities, and, in the second place, it is noticeable for a tacit acceptance of the common assumption that any objection to the way in which a public trust is administered implies a demand for a change in the machinery by which its administration is effected, and does not, as might more naturally be thought, perhaps only exhibit a desire to see the power that directs the machinery made more intelligent. If our cities are badly governed by mayors and councils, the remedy is sought in government by commission or in some other purely mechanical attempt to change the locus of power, instead of in the more laborious and less outwardly promising task of purifying it of selfishness and ignorance; and President Van Hise seems to deal with the question of university government from a similar point of view, although, to be sure, he does so for the most part negatively and by inference rather than positively and directly. He is undoubtedly right in his contention that the president is the proper officer to be entrusted with the power of appointment and removal; although many will question his implication that the president's right to this power rests on the fact that he makes wise and courageous use of it. He is also right in insisting that removals are necessary when efficiency or usefulness are destroyed by physical, mental or moral weakness; and he is justified in attributing some (but not all) of the opposition of faculties to the presidental power of appointment and removal to their selfish desire for permanent sinecures; but his address implies an attitude on some other points to which exception may be taken.

For one thing, he is too sanguine; for he assumes two things that there is considerable reason to doubt. He seems to think, first, that the acts of governing boards of universities are always in the interests of the students and the public; and, second, that public condemnation is visited swiftly and certainly on all college presidents who employ the power of removal with even a suggestion of unreasonableness or injustice. That these two assumptions are justified may fairly be called into question.

One of the greatest weaknesses of American universities, according to an opinion of wide prevalence, is their governing boards. These

bodies, composed for the most part of men without anything but the most superficial knowledge of educational practise, often without liberalizing experiences or any real intellectual training, may afford avenues of approach to funds available for the support of educational activities; but they can take no constructive part in educational work, and therefore their action is most intelligent when it is purely perfunctory; as, fortunately, it is for the most part. This is a very general estimate of the worth of governing boards, and there is evidence to bear out its correctness in President Van Hise's address. He says that governing boards merely consider the question of finances in establishing new chairs; so, we may suppose, that if any faculty should so far forget itself as to imagine that a chair of mendacity was necessary, the average governing board would merely count up its cash and determine by that action alone whether to establish it or not. Of course it will be objected that this is a flippant and incomplete way of stating the situation, and that governing boards limit their direct responsibilities to financial matters, leaving all questions of instruction to the sole decision of the faculty. This answer is unconvincing, however, because it is impossible to consider the financial and the intellectual sides of such questions separately, and because it is not fair that the faculty should have only responsibility and no authority in such matters. The fact that there is a strong feeling that governing boards have much power that they do not use intelligently, and that they exercise much authority without being willing to accept a corresponding degree of responsibility, is probably a stronger reason than the one given by President Van Hise for faculty objection to the interference of outside bodies in the matter of teaching appointments. The remedy for this condition, however, does not lie in changing the functions of the officers who interfere or in abolishing them, but in changing their character so that their action on such matters shall be intelligent. If university governing boards were selected with more discrimination than they are at present, and were therefore able to give intelligent consideration to all the larger questions that confront their institutions, many other problems besides those in connection with the appointment and removal of officers of instruction would be solved, and complaints of appointments due to favoritism and expediency or of flagrantly unjust removals could be dismissed as the cry of irritated incompetence—something that can not be done with many that are now made.

It would be pleasant to be able to believe that the public is sure to reprehend any abuse of the power of appointment or removal, but any one who is familiar with the way in which that power has been exercised in many of our universities will have some difficulty in doing so. The public is likely to take an interest in the case of a man whose removal can be attributed to his political or religious opinions; but where only intellectual fitness and teaching efficiency are involved it shows little interest, unless by some accident the case becomes exploited sensationally. It is very much as it is with the exercise of political power. On certain irregular occasions there is great excitement over the appointment of an incompetent or the removal of an efficient public officer, but as a general thing it is taken as a matter of course that such acts shall be unintelligent and inspired by selfishness oftener than a sense of duty. In Science for August 19, 1910, Professor A. W. Crawford, of Manitoba University, has a letter calling attention to the fact that the University of Pittsburgh, by faculty changes that involved the removal of two professors, effected a saving of $2,000 a year, but that $1,500 of it was added to the salary of the executive officer who made the removals. If the facts are as stated, it would seem that the University of Pittsburgh would be an especially good place to establish a school of politics, as the performance would do credit to some of our most abused municipal governments. The public, however, does not seem to have been at all disturbed by it, in spite of the fact that a reform wave struck Pittsburgh about the time it was done and several councilmen were indicted.

Another illustration of the way the public takes removals can be found in the case of Brown University. A dozen years ago the removal of a man from this institution stirred the whole country. The man, however, was the president of the university; he had guided it during the period of its greatest development; was, perhaps, its most distinguished living alumnus; and he was removed for holding opinions that were an issue in national politics at the time. Ever since that time, according to common report, the power of removal has been invoked in the same institution with great frequency against less conspicuous men. Repeated complaints have been raised of men having been cajoled, crowded or thrust out of the Brown faculty with varying degrees of suddenness and consideration. In some cases the men so treated had served the university for many years without being found incompetent or even unworthy of regular promotion—something which in most institutions is regarded as establishing a claim that prevents removal on the ground of natural unfitness. In other cases, whatever the justification for removal, the action was accomplished in a way to rob it of all appearance of tact and dignified decision; and yet the public has shown no disposition to visit reprehension on the institution; although, according to President Van Hise, it would be sure to do so under circumstances far less capable of being interpreted as indicating unwise or unjust action.

The fact that removals are sometimes necessary does not justify the inference, as President Van Hise implies it does, that every removal made is a just and wise one. It is because faculties feel that many are both unwise and unjust that there is so much complaint against the power that makes them; and it is the fact that there is some warrant for this feeling that gives these complaints their force. Even if all removals were justified, however, President Van Hise's address shows that executive officers would not be free from all blame in connection with them. He states that the college president usually approves without question all nominations for minor appointments, and that only in the case of promotions or appointments to positions of professorial grade does he give the matter any personal attention. He might have added, had it lain within the scope of his paper, that many universities exploit their minor appointments in various ways, and by so doing attract many men into teaching who later on have to be removed. It must be admitted that some probation is necessary before the fitness or unfitness of a teacher can be determined, and it may be that a college president's time has too many demands on it to permit him to consider every minor appointment. It requires, however, something else besides experience to make a teacher, for some mental equipment and training is necessary on which to superimpose that experience; and it lies within the power of college presidents to insist on the possession of this equipment and this training. It is also within the power of college presidents to stop the practise of appointing men to minor teaching positions for no better reason than the fact that they will swell the number of graduate students. As to whether a president can reasonably be expected to have time to devote to considering minor appointments, it can only be said that if he has not, it might be well to create officers to relieve him of some of his duties and enable him to do so. A travelling press agent might serve the purpose. Such an officer could relieve the president of the junketing and of the task of conducting the enthusiasm campaigns that are now deemed necessary to keep a university prominent in the race for numbers and notoriety, and the president could be left free to devote himself to more purely intellectual matters. It might even be found that the press agent was unnecessary, and that if college presidents devoted themselves more to their natural responsibilities, the gain in efficiency might prove to be a far more effective advertisement than the most ingenious press agent could ever devise or the most energetic one ever carry out.

But if it is not possible to agree with Presi-

dent Van Hise that college presidents should be entrusted with the power of appointment and removal because they invariably use it in the interests of efficiency and justice, it is possible to believe so for other reasons. In the first place, if the president makes the appointments responsibility can be brought home to an individual; whereas, if the faculty made them, it would be distributed among a body of men, and individuals could evade it. Then the president ought to be better able to perceive the needs of the whole institution than the faculty; for the views of faculty members are sure to be narrowed by an inevitable tendency to give undue importance to their own and allied subjects. A still more important reason for the president's making the appointments, however, is the fact that he is not like members of the faculty influenced by a fear of competition. It is natural that professors on whom the task of recommending appointments falls should prefer docile mediocrity to men of ability sufficient to develop into rivals for the positions they hold. Intellectual men are proverbially jealous, and the keenness with which they scent rivalry is remarkable; so it is not to be wondered at that promising men find the gateway to teaching closely guarded against their entrance, and that those who succeed in slipping by soon find their path so obstructed that many of them retire in disgust. This is something for the president to correct. His penetration should be sufficient to detect this practise; his courage, decision and dignity sufficient to suppress it and to replace it by a spirit of earnest emulation between teachers of the same as well as different subjects. Unfortunately college presidents do not seem now to be selected because they possess inspiring moral and intellectual qualities, but, one is often tempted to believe, because they can clothe popular fallacies and meaningless commonplaces in language of seeming profundity, or because they are skilful in a sort of emasculated machiavellism. When the public learns to take its responsibilities to education more seriously, we shall have college governing boards and college presidents who discharge their duties more intelligently, and this in turn will ensure faculties of higher effectiveness; so that the whole machinery will acquire a nicety of adjustment that will enable its various parts to work together without the friction that takes place between them now.

It would seem, then, that President Van Hise is right in saying that the present machinery of education needs no external modifications, but it is impossible to accept his implication that educational results are satisfactory. As a matter of fact, present results are very poor, not only in the matter of appointments and removals, but in a general way as well. The only way to improve them, however, is to render the real guiding power of education—public opinion—more intelligent.

Sidney Gunn

Massachusetts Institute of Technology,
March 3, 1911

SCIENTIFIC BOOKS

A NEW TRANSLATION OF ARISTOTLE'S "HISTORY OF ANIMALS"[1]

"The History of Animals," by Aristotle, much as it is referred to by naturalists as well as others, has never appeared until lately in a fitting English dress. At last a translation has been published from the pen of a scholar who combines, to an eminent degree, the principal qualifications necessary for such an undertaking—an adequate knowledge of the Greek language and acquaintance with the Grecian fauna. D'Arcy Wentworth Thompson, professor of natural history in University College, Dundee, is the man to whom we are indebted for the new work. It "has been compiled at various times and at long intervals during very many years" and was so long delayed that we had almost despaired of see-

[1] The works of Aristotle translated into English under the editorship of J. A. Smith, M.A. [etc.], and W. D. Ross, M.A. [etc.], Vol. IV., Historia Animalium by D'Arcy Wentworth Thompson, Oxford, at the Clarendon Press, 1910. 8vo, pp. xv + 486[a]–633[a] + 151.—$3.40.

ing it in print, but we are glad at length to welcome its appearance.

I

Besides various abortive attempts and fragmentary translations, two completed English versions of the "History of Animals" had been published, one in 1809 by Thomas Taylor and another in 1862 by Richard Creswell. Both works evince not only an inadequate knowledge of Greek, but an extremely imperfect acquaintance with zoology and consequently would very frequently mislead the reader. The following extracts from the three translations will serve to give an idea of the characteristics of the several versions and might be paralleled to an indefinite extent:

APES, etc.

Taylor, p. 48 (II., viii., ix.).

Some animals however have an ambiguous nature, because they partly imitate man and partly quadrupeds, such as apes, the cœbi [a kind of apes] and the cynocephali. But the cœbus has the tail of an ape; and the cynocephali have the same form with apes, except that they are larger and stronger, and they have a more canine face. Their manners also are more savage, and they have teeth more canine and strong.

Creswell, p. 32 (II., v., 1).

Some animals unite in their nature the characteristics of man and quadrupeds, as apes, monkeys and cynocephali. The monkey is an ape with a tail; cynocephali have the same form as apes, but are larger and stronger, and their faces are more like dogs' faces; they are naturally fierce, and their teeth are more like dogs' teeth, and stronger than in other genera.

Thompson, 502ª, lines 16–22.

Some animals share the properties of man and the quadrupeds, as the ape, the monkey and the baboon. The monkey is a tailed ape. The baboon resembles the ape in form, only that it is bigger and stronger, more like a dog in face, and is more savage in its habits, and its teeth are more dog-like and more powerful.

These are versions of the following Greek original copied from Bekker's edition:

Ἔνια δὲ τῶν ζώων ἐπαμφοτερίζει τὴν φύσιν τῷ τ' ἀνθρώπῳ καὶ τοῖς τετράποσιν, οἷον πίθηκοι καὶ κῆβοι καὶ κυνοκέφαλοι. Ἔστι δ' ὁ μὲν κῆβος πίθηκος ἔχων οὐράν. Καὶ οἱ κυνοκέφαλοι δὲ τὴν αὐτὴν ἔχουσι μορφὴν τοῖς πιθήκοις, πλὴν μείζονές τ' εἰσὶ καὶ ἰσχυρότεροι καὶ τὰ πρόσωπα ἔχοντες κυνοειδέστερα, ἔτι δ' ἀγριώτερά τε τὰ ἤθη καὶ τοὺς ὀδόντας ἔχουσι κυνοειδεστέρους καὶ ἰσχυροτέρους.

A comparison of the several versions with the original shows that Taylor's is quite unreliable, Creswell's is the most literal, and Thompson's correct, free and the most idiomatic from an English point of view.

Taylor has corrupted the word kebos into cœbus, for which there is no justification, and has reversed what Aristotle said as to kebos, the original author declaring that it is a pithekos with a tail.

Creswell's chief fault, in this paragraph, is the omission of the English equivalent for "cynocephali"—baboons; the last four words are uncalled for.

Thompson's is pervaded with a full knowledge of what Aristotle said. He has preferred to change the number in several cases, giving the singular instead of the plural. His use of the word ape (instead of macaque), in common with his predecessors, may mislead many, inasmuch as ape is now so generally restricted to the large, tailless simiids (chimpanzee, gorilla, etc.) that they are involuntarily brought to the mind, to the exclusion of others, by the word. Nevertheless, Professor Thompson may claim perfect justification in the fact that the word originally included the monkeys and that the macaques are still popularly known as apes, the northernmost and typical species being especially called Barbary ape. Some might also prefer to express Aristotle's meaning by a phrase like "Some animals combine in their shape characteristics of man and quadrupeds."

One more example (descriptive of the Greek catfish glanis) will illustrate other weaknesses of the older translators. Book VIII. of the "History" is under consideration.

THE GLANIS

Taylor, 325 (VIII., xx.).

. . . the glanis, in consequence of swimming on the surface of the water, is injured by the deadly influence of the dog-star, and is laid asleep by very loud thunder. Sometimes, likewise, the carp is affected in this manner, but in a less degree.

But the glanis perishes when struck in shallow water by the serpent called a dragon.
Creswell, p. 219 (VIII., xx., 12).

. . . the glanis, from its swimming near the surface, appears to be star-struck by the dog-star, and it is stupefied by loud thunder. The carp suffers in the same way, but not so severely. The glanis, in shallow water, is often destroyed by the dragon-serpent.
Thompson, 602[b], lines 22–26.

For instance, the sheat-fish just before the rising of the Dog-star, owing to its swimming near the surface of the water, is liable to sunstroke, and is paralysed by a loud peal of thunder. The carp is subject to the same eventualities, but in a lesser degree. The sheat-fish is destroyed in great quantities in shallow waters by the serpent called the dragon.

Taylor and Creswell both attribute remarkable offensive powers to the dog-star instead of considering the reference to it as an index of season.[2] The notice about the dragon serpent gives an undue air of mystery and weirdness.[3] A water snake may seize a catfish as well as other fishes, but sometimes with a fatal result. (The present writer, on one occasion on the shore of the Potomac River near Washington, found a large water snake (*Natrix sipedon*) dead with a catfish's trunk in its mouth but the head outside and the pectoral spines immovably outstretched, one piercing the snake's skin behind the corner of the mouth and the other outside.)

Professor Thompson has chosen to use the name sheat-fish as an equivalent of glanis. That name has been in limited use for several centuries as the designation of the *Silurus glanis* of Europe and has given trouble to lexicographers. For example, in the "Century Dictionary," it is derived "appar. < sheat[2], a shote, + fish."[4] It was given by Willughby, in 1686, as the English synonym of the German Shaid or Schaid. Schaidfisch is an equivalent in northern Switzerland (round Lake Constance or Bodensee) for the same species and doubtless sheat-fish has been derived from that name. The English form, to a very limited extent (as by Arthur Adams in 1854), has been used in a wider sense. Inasmuch, however, as glanis is a well-known specific name and the fish so called by Aristotle is quite a different species from the true sheatfish, adherence to the practise of his predecessors in retaining glanis would be deemed desirable by many.

II

Aristotle has been frequently and recently called "the founder of systematic zoology." A very distinguished anatomist (Richard Owen) even claimed that "the Zootoka of Aristotle included the same outwardly diverse but organically similar beings as constitute the Mammalia of modern naturalists." All such claims are baseless. In view of the frequency with which they and the like are repeated, however, explanation of the scope of Aristotle's work is in place.

A striking example of Aristotle's failure to understand principles of natural classification, and fundamental characteristics of animal groups, is exemplified by his treatment of the group of Selachians. This, as now accepted, is a very natural division to which class rank has been assigned by some of the best modern naturalists, but Aristotle has ranked with them the angler or fishing frog (*Lophius*) which is only a slightly modified acanthopterygian fish; he did this merely because it was a flat flabby fish and he approximated it to the torpedo because that also was flat and flabby. The fact that he repeatedly asso-

[2] The dog-star has been long used as a denominator of time. For example, Linnæus in 1741, in his autobiographical sketch, records that in the dog-days he reached Rouen, on his way to Stockholm, which he reached in September.

[3] The "dragon" of the History of Animals was apparently nothing more than an ordinary snake to which extraordinary habits were attributed by popular belief.

[4] *Sheat*[2] is defined "The Shad. Wright. [Prov. Eng.]," *Shote*[1] "same as Shot[3]," the trout or grayling, and *Shote*[2] "a young hog; a pig" and "a thriftless, worthless fellow." In the old editions of the great "Greek-English Lexicon" by Liddell, Scott and Drisler, *glanis* is defined "a kind of *Shad.*" The glanis belongs to a widely distinct order from the shad and trout and is not at all like them.

ciated the angler with the rays precludes the idea that the error originated with an editor or copyist. Many other cases of misplacement of animals, on account of superficial similarity, which differ fundamentally, might be cited did our limits permit. It need only be repeated that Aristotle was not "the founder of systematic zoology" and had little or no appreciation of what is now so termed.

The "History of Animals," indeed, is by no means a treatise on systematic zoology, but rather a work on physiology. It generally includes nine "books," but a tenth was formerly recognized which is now universally regarded as spurious. In general terms, in the first three the parts and regions of "blooded" or vertebrate animals are considered; in the fourth the "bloodless" or invertebrate animals and the senses generally are noticed; in the fifth and sixth generation and breeding habits are described and, in the seventh, especially those of man; the eighth and ninth books treat "of the psychology of animals," including the feeding and general habits. These categories are by no means exact, however, and various miscellaneous information is interjected. No data are given for the determination of the animals considered except what may be found in scattered places respecting certain characteristics, and many species are only noticed once. It is assumed that the reader will know the animals by the vernacular names of the time.

There is nothing like a system of the animal kingdom and the groups are only such as were and still are recognized by people without special knowledge of natural history. The only categories of classification are the *genos* (genus) and the *eidos* which correspond almost exactly with kind and species or variety of English and are equally vague and to some extent interchangeable. Indeed, as Thompson notes (490^b), Aristotle sometimes "seems to juggle with the terms εἶδος and γένος." The only group designations are those in general use, agreeing with English popular appellatives. Aristotle especially names the most comprehensive "genera" or kinds of "blooded" animals in book I. (Thompson 490^b 9 and 10) and of "bloodless" animals in book IV. (523^b 4–13); the former are Ornithes (birds), Ichthyes (fishes) and Ketoi (whalekind); the latter are Malakia (cuttlefishes), Malakostraca (soft-shelled shellfishes), Ostrakoderma (true shellfishes) and Entoma (insects). Thus each of the Aristotelian "great genera" has received popular recognition among the English as well as other peoples. Aristotle, it is true, says (Thompson, I., 490^b 9–11): "There is another genus of the hard-shell kind, which is called oyster; another of the soft-shell kind, not as yet designated by a single term," which he later (IV., 523^b 5) designated as malakostraka; it does not necessarily follow, however, that Aristotle coined the word for the group; he doubtless took an already existent adjective and used it as a substantive. A few minor kinds or combinations are recognized, as cetaceans (ketoi), selachians (selachia), horse kind (lophuri) and cuttlefishes (malakia), but otherwise the animals "are only named as it were one by one, as we say man, lion, stag, horse, dog, and so on" (I., 490^b 34).

About five centuries later Apuleius, in his singular "Apologia" or "Defence," gave a list of collective designations or aggregates of animals, and Aristotle's group names constituted practically all the natural groups or classes of the fourteen recorded. (Works of Apuleius, Bohn ed., p. 286.) Many centuries were destined to roll away before the list was added to. Indeed, not until the eighteenth century did any naturalist give name to a class independent of popular recognition. Linnæus was the real founder of systematic zoology. It is true that he was to some extent anticipated by Ray in the previous century, but Ray did not give nomenclatural expression to his logical concepts.

Inasmuch, then, as the *genos* and *eidos* are the only categories which have received distinctive names, they only should be recognized. Professor Thompson has done this, but he has used the word "genus" in the same vague manner as Aristotle. That designation, however, has been restricted by modern naturalists to a group of closely related species and often to a single species when that

had no known close relations. The use of the word in the vague Aristotelian sense, therefore, will mislead or at least divert attention, and there is no good reason why kind should not be employed. Oliver Goldsmith, however poor a naturalist, was a master of English and he used that word much as Aristotle did genos. Thompson's method, however, is far preferable to another translator of Aristotle. Dr. Ogle, in his generally praiseworthy version of "Aristotle on the Parts of Animals" (p. 142), explains that "The vague use of the term [genos] makes it impossible to translate it invariably by the same English word. I have therefore rendered it variously — genus — order — tribe — class — natural group — kind, etc., as seemed most convenient in each separate case." Such practise does not convey what Aristotle said or meant, but what the translator thought he ought to say. Most readers will want to know what Aristotle's ideas were and not the editor's.

Another case of usage of a word in a different sense from that current is exemplified by the term malakia, which Professor Thompson has translated by mollusks. Inasmuch as the latter word is universally extended by all naturalists to a great branch of the animal kingdom, of which the malakia form but a small and aberrant fraction, we certainly have some cause to demur; cuttlefishes is an exact English equivalent of malakia. We would prefer to use the last name with the English synonym after it within parentheses. Perhaps others would prefer cephalopods instead.

Undoubtedly many will also wish that Professor Thompson had given the Greek names of species rather than their supposed English equivalents or, rather, in connection with such equivalents. He has, indeed, done so often, but only because he was ignorant or uncertain of the intent of a name. There are probably few readers who would use Aristotle for information about animals; most persons would want to know what names he used for animals and what he said or thought about them. Besides, the greater part of the English-reading people live outside the British Islands and to them such words as adder, angelfish, ant, blackbird, dogfish, grasshopper, lizard, viper and the like may convey a different meaning from that familiar to a native Englishman.

III

If Strabo is to be credited, some of the manuscripts of Aristotle were subjected to extraordinary vicissitudes and only resurrected after more than a century's entombment in dark and damp hiding places. If such were the case[5] with the "History of Animals," naturally in very many places the ink must have been blurred or sometimes completely obliterated. It is told that one Apellicon of Teos attempted the restoration of copy and that various editors of subsequent but early times tried their hands at improvement of the text. Naturally, then, the Aristotle we know must be often different from that which originated from the hand of the great stagirite.

Many emendations have been also made or proposed by various later commentators on Aristotle and many new ones have been suggested by Professor Thompson. Thompson had earned the right, by virtue of his attainments and research, to make such, but some of his predecessors had not. A flagrant case of ill-advised alteration has been furnished in connection with the words *skaros* and *sparos,* the names of two very notable fishes.

Certain authors have proposed to substitute the word *skaros* for *sparos* when it occurs in Book II. (508^b 17);[6] Horace A. Hoffman (1892) was misled by the suggestion and became so confused that he was "inclined to think that the names σάργος. σκάρος and σπάρος are used indiscriminately," and even failed to recognize the *scarus,* perhaps the most famous

[5] There is internal as well as other evidence that the History of Animals was published (multiplied) during Aristotle's life-time.

[6] In this case and the following references the first number in roman refers to the "book" of Aristotle's "History" (II.), the second to the page of the Prussian Academy's edition adopted by Thompson (508^b), and the third to the line of the page (17). There is no other or independent pagination for the version.

fish of the ancients. There is really no confusion in Aristotle's book and his characterizations of the several fishes are quite apt. For instance, according to Hoffman, Aristotle "says the σπάρος (or σκάρος, if we follow the other reading) has many pyloric appendages," [etc.] and that the σκάρος "has its stomach shaped exactly like an intestine, seems to ruminate just as the quadrupeds do," [etc.]; these characters differentiate the two almost as well as a modern ichthyologist would do.

But there is certainly often occasion for emendation of the generally accepted text and one striking example is the nomenclature of certain fishes which are provided with cæca to the intestines; it occurs in book II. (p. 508[b] 17) of Thompson's translation. Probably Aristotle's manuscript had become blurred and illegible at this place and a copyist had inserted words that looked like those that were indistinct or were of the same length.

According to Thompson's version, "Fishes have them [cæca] high up about [round] the stomach, and sometimes numerous, as in the goby, the galeos, the perch, the scorpæna, the citharus, the red mullet, and the sparus." Now, assuming that Aristotle knew what he was writing about, the present text is very corrupt.

The goby (κωβιός) has no cæca whatever and consequently the name must have been substituted for some other. κολίας may have been the original word and the species indicated (*Scomber colias*) would to an eminent degree fulfil the requisite (having very numerous cæca) for the place.

The galeos—"γαλεός or the dog-fish, a selachian"—as Thompson notes—"has no cæca. Sch. suggests γαλῆ (cf. Ael. xv., 11), mod. Gk. γαλία, *Lota vulgaris*, the burbot." That fish has many cæca and therefore would "fill the bill," but unfortunately there is no recent evidence (in Apostolides, Hoffman, Carus or any other recent author) that the fish or the name occurs in Greece. A species that would well answer is the bonito (the μαίᾳ of Aristotle, *Sarda pelamys* of recent systematists), which is next in relationship to the *kolias* and whose intestines had elsewhere (506[b] 14, 15) been especially noticed by Aristotle.

The perch of Thompson (in this place) is not the river perch but a serranid (*Serranus scriba*) still known in Greece as the περκα, which has many cæca.

The *citharus* does not fulfil the requisites of the proposition in question and is out of place; the name doubtless has been interpolated; κάνθαρος may have been the original word.

The names *chromis* and *korakinos* have been involved with *skiaina* to some extent. Thus in book IV. (534[a] 9, 10) the "Chromis or Sciæna" is reckoned among "fishes the quickest of hearing," but in book VIII. (601[b] 31) the two names appear for distinct species which suffer "most in severe winters" because they "have a stone in their head, as the chromis, the basse, the sciæna and the braize." Thompson, in a note (IV., 534[a]), declares that the chromis was "*Sciæna aquila* (or some closely allied fish) said to be still called *Chro* in Genoa and Marseilles." The *Coracinus* has been variously identified. "According to Cuvier and J. Müller," it was, says Thompson, "*Chromis castanea* (It. *coracino, corbo,* etc.), the allied fish from the Nile (Athen. *l. c.* [viii., 312]) being *C. niloticus. Umbrina cirrhosa* and *Corvina nigra* are known as *corvi,* and are said to spawn in brackish water, but these we identify with σκίαινα or χρόμις." Günther thought that "the *chromis* of the ancients appears to be some sciænoid fish." Investigation of the voluminous literature respecting the species involved and the fishes themselves has led to the following conclusions:

The *Skiaina* was probably primarily the *Sciæna umbra* of Linnæus (*Corvina nigra* of Cuvier), known now in Greece as the *skios,* as well as under other names.

The *Chromis* was apparently the *Umbrina cirrhosa,* to some extent at the present day confounded with the former under the name skios, umbrina, ombrella, etc.

The korakinos, as Cuvier and J. Müller believed, may have been the *Chromis chromis* (*Heliastes chromis* of Günther). "The allied

fish from the Nile," referred to the same genus by Cuvier, has for more than half a century been associated with numerous other African fishes in a distinct family (Cichlids) and its generally accepted name now is *Tilapia nilotica*. *Coracinus* was, however, long a popular name for it, and the "Coracin fish" of Josephus ("Wars of the Jews," III., 10, 8) was doubtless the same or one of the closely related species.

The genera *Sciæna* and *Umbrina* belong to the family of Sciænids and *Chromis* to that of Pomacentrids.

Apropos of the sexual relations of the selachians, Aristotle brought together most of the names of the species he knew. After specific notices of the *batos* (ray), the *trygon* (sting ray) and the *rhine* (angelfish), in Thompson's version (V., 540^b 17) we have this enumeration: "And among cartilaginous fishes are included, besides those already named, the bos, the lamia, the aetos, the narce or torpedo, the fishing-frog, and all the galeodes or sharks and dogfish."

Professor Thompson thinks that the bos is "probably *Notidanus griseus*" and the lamia "one of the greater sharks, *e. g.*, *Carcharias glaucus*, or *Carcharodon Rondeletii*." Such can scarcely be the case. Aristotle generally instinctively approximated like forms and he especially segregated "all the *galeodes*" (*πάντα τὰ γαλεώδη*). Inasmuch as the *bos* and *lamia* head the list of flat selachians, they were doubtless rays.

The *bos* (*bous*) was almost certainly the *Mobula edentula*, otherwise named *Cephaloptera* or *Dicerobatis giorna*. It is known by analogous names (vaca, vacchietta) along the coasts of France and Italy, and allusion is thereby made to the horn-like headfins (caropteres) which project forwards and forcibly remind the observer of a cow's horns. Devilfish is the name by which kindred forms are known along the American coasts.

The *lamia* may have been intended for overgrown individuals of the *bous* known only through exaggerated reports. It was possibly interpolated by a later editor.

The *aetos* was undoubtedly the eagle ray, *Myliobatis aquila*. The name is generally supposed to refer to the widely spread wing-like pectoral fins, but Professor Thompson has "little doubt that the original name, still preserved in Sicily, was *pisci acula*, or *ἀκυλέης*." It is the wing-like expansion and use of the pectorals that is the most striking characteristic of the eagle rays; the spines they share in common with the sting rays (Dasybatids). Professor Thompson might support his conjecture, however, by the fact that, in America, the eagle rays are to some extent called sting rays in common with the dasybatids.

The *φύκης* (male) or *φυκίς* (female) is named by Thompson "the little phycis or black goby" (567^b l. 19) or merely phycis (591^b 16, 607^b 20). The fish is thus identified unhesitatingly with the *Gobius niger*, as was done by Apostolides, who followed Cuvier and Nordmann. The early writers, however, so identified the phykis merely because it had become known as a nest-maker and no other nest-maker than the goby was known. Nevertheless, it is now certain that the Aristotelian fish was not a goby but a labrine. It was declared by Speusippus (in Athenæus) to be like a sea-perch (*Serranus*) which the *phykis* is not; it was associated with labrines by Aristotle (607^b 18), and it is still called phykopsaro in Greece. It is also now well known that several of the European labrines construct nests; those labrines are much more conspicuous and more like the serranids than are the gobies. The *phykis* was therefore identified with a Crenilabrus by Gerbe as early as 1864 and there can be little if any question that it really was a labrine. It was indeed considered by Belon, more than three centuries ago (1580), to be one of the fishes now known as *Crenilabri*. As Gerbe's fine article is almost unknown, it may be noted here as published in the *Revue et Magasin de Zoologie* for 1864 (pp. 255–258, 273–279, 337–340). The nest of a northern species (*Labrus maculatus*) has also been described by J. D. Matthews in the Fifth Annual Report of the Fishery Board for Scotland (1886–7, pp. 245–247).

Among the migratory fishes (IX., 610^b 6, 7) are mentioned "the sarginus, the gar-fish,"

etc. Professor Thompson notes that "while *βελόνη* in VI., 12, etc., is certainly the pipefish, *Syngnathus,* here it may be assumed to mean *Belone acus,* the garfish: Mod. Gk. *βελονίδι, σαργάννος, σαργώννος;* It. aguglia. *σαργῖνος* and *βελόνη* are probably synonymous, and one or other of them is interpolated." But here, as elsewhere in the "History," the *Belone* is undoubtedly the pipefish. The garpike and pipefish are both very elongate and have the preocular region extended and consequently are sufficiently alike superficially to contrast with other fishes. Assuming, then, that the *belone* is the pipefish, the juxtaposed *sarginos* (not mentioned elsewhere) might be conjectured to be the garfish; the conjecture is sustained by the fact that the garfish in modern Greece and the archipelago bears the names Sargannos and Sargōnnus (as Professor Thompson records), as well as *Sargannos* and *Zargana;* these names are clearly but slight variants of each other as well as from *Sarginos* and the real similarity is scarcely veiled by the vagaries of orthography.

In the index, Professor Thompson distributes the references to *belone* under two categories, (1) the pipefish, 567^{b}, 571^{a}; (2) the garfish, 506^{b}, 543^{b}, 610^{b}, 616^{a}. As already indicated, we consider all the passages in question to be referable to the pipefish, and that alone.

In book IX., Aristotle notices the halcyon or kingfisher and especially the nest; he conjectures that "it is possibly made of the backbones of the" *belone,* which Professor Thompson translates "garfish." In a note he adds: "If we ask why of all fishes the *βελόνη* is specified, it may be because the backbone of the garfish has a peculiar green colour." The Grecian kingfisher, as Aristotle says, "is not much larger than the sparrow," and the garfish is a comparatively large animal and difficult to catch; on the other hand, pipefishes are small, readily obtainable in the vegetation near the shore, and the partly desquamated bodies are easily identifiable.

The question of the nomenclature of the *belone* and *sarginos* has been fully considered in an article "On the Families of Synentognathous Fishes and their Nomenclature" in the *Proceedings* of the United States National Museum (1895, pp. 167–178). To this reference may be made for further details.

IV

Here we must bring our already too lengthy review to a close, although many other passages had been marked for comment or praise. The review has been mostly confined to one class because representatives of that class have been most misunderstood and many species erroneously identified. Professor Thompson's acquaintance with other classes has been greater and he had some years ago published an excellent book on Greek birds.

The new "History of Animals" deserves further commendation on account of its dress as well as contents. It is printed in excellent form, as would be expected, having come from the Clarendon Press. A new feature, so far as English editions are concerned, is the illustration of various passages by apt and clear figures (eleven in number) explanatory of the Greek text which is subjoined. There are remarkably few typographical errors. Such are inevitable, however, in a work of its magnitude, and among them are the transposition of the figures 1 and 2 in explanation of the illustration of *Squilla mantis* (525^{b}), 185 instead of 1856 (568^{a} note), and *mormirus* in place of *mormyrus* (570^{b} note). There is one other lapsus to which attention may be called because it is so often made by other writers.

Professor Thompson has been misled several times by a French custom of individuals or families adding agnomina to their names. The distinguished publicist and translator into French of Aristotle's works, Jules Barthélemy Saint-Hilaire, and the great French naturalists, E. and I. Geoffroy Saint-Hilaire,[1] are all referred to only under their agnomina. In conversation and "for short" the agnomen would be generally dropped, Barthélemy only being used for one and Geoffroy for the other. Thus Cuvier, once the intimate associate of

[1] The "G. St. Hilaire" of p. 612^{a} (note) was Étienne Geoffroy Saint-Hilaire (father) and that of p. 631^{b} Isidore Geoffroy Saint-Hilaire (son).

Isidore's father and later his antagonist, almost always referred to Étienne Geoffroy St. Hilaire as "M. Geoffroy." In bibliographies and catalogues the respective names are to be found under Barthélemy and Geoffroy.

These are certainly very few and really unimportant blemishes to a work of such general excellence. Before the appearance of the volume, the English-reading peoples were far behind the French and Germans in versions of the "History of Animals." Now we are ahead of all and it will probably be long before it can be superseded by another. Before such shall be the case, the fauna of Greece must be thoroughly explored and doubtless in some sheltered nooks names of animals that have perished in places investigated may be still found in use as in Aristotle's time but under variant modifications. Meanwhile, we shall have reason to congratulate ourselves on the superiority of that which we have.

Theo. Gill

NOTES ON METEOROLOGY AND CLIMATOLOGY

Though authorities agree that climate is practically unchangeable, except when geological time-units are considered, this problem, and especially the corollary relating to mild winters and severe springs, has aroused considerable discussion. The backwardness of spring during the last few years in many parts of the United States has caused considerable alarm among those who are directly affected. In Missouri orchardists have begun to question the policy of continuing the attempt to raise fruit on an extensive commercial scale. In view of these facts, Mr. George Reeder, section director of the United States Weather Bureau, made a study of the cause of the alarm. His investigation has been summarized in a paper, "Late Spring Frosts in Relation to the Fruit Crop of Missouri," which was read at the January meeting of the Missouri State Horticultural Society. It is reprinted in part in the *Monthly Weather Review* for December, 1910. He points out the fact that the daily minimum temperature, rather than the mean temperature for the day, is the important factor, for it is the extreme minimum rather than the mean daily temperature that affects vegetation most. As far as minimum temperatures are concerned, the springs of the last ten years, and particularly the last five years, averaged colder than those of the preceding fifteen years. Not only is the average of the daily minimum temperatures for April and May lower in the last decade than in the preceding two decades, but the frequency of freezing temperatures during these months has been greater of late than formerly. While this is an apparent substantiation of the popular notion that "our climate has changed," he cautions the reader from drawing such a conclusion, suggesting that these changes occur in cycles or oscillations. Data for a sufficiently long period are not available for determining the lengths of these cycles, or for forecasting a change in the present conditions. In conclusion he says, "The popular idea that the climate is changing is evidently an old one, and is caused by the temperature and precipitation conditions remaining for comparatively short periods below or above the normal conditions; such changes should be referred to as oscillations in the weather rather than as changes in the climate."

"The Practical Application of Meteorology to Aeronautics," a paper which was read by the author, Mr. W. H. Dines, before the Aeronautical Society of Great Britain, appears in the *Aeronautical Journal* for January. He showed that the density, the temperature and especially the motion of the atmosphere are of considerable importance to the aviator. The decrease in density of the air with height results in a loss in supporting power, but since the actual resistance to forward motion becomes less, greater speed is possible. The decrease of temperature with height renders it necessary for the aviator to wear thicker and therefore heavier clothing. However, by far the most important consideration in this connection is the wind, both in respect to velocity and to direction. Wind affects aviation in two ways, (1) by its actual presence, and (2) by its steadiness or gustiness. From data obtained by means of kites and balloons, certain

principles have been recognized. For example, if one knows the barometric gradient at the ground he can compute approximately the velocity of the wind for moderate heights with the aid of Ferrel's formula and the known rate of increase of velocity with height. Moreover, the change of wind direction with height can be foretold when one's position with respect to the barometric distribution is known. Such information is of value both to the aeronaut, who in the free balloon seeks a desirable current by ascending or by descending, and to the aviator, who in an aeroplane can travel more advantageously with the wind than against it. In the opinion of Mr. Dines, progress in the art of mechanical flight depends largely upon meeting and overcoming the difficulty of the gustiness of the wind. Many accidents have had their origin in this condition, which is always present in a more or less degree. When it is serious enough to render flying hazardous the professional aviator aptly says that the air is "full of holes." In various ways it has been determined that the wind becomes steadier with increasing height, except within the stratum of fracto-cumulus clouds, when they are present. Increased speed does not result in increased stability unless the construction of the aeroplane is proportionately strengthened. These, and other facts based upon the meteorological data of Blue Hill Observatory are shown graphically, as well as verbally, in a book called "Charts of the Atmosphere for Aeronauts and Aviators," which is now in the hands of the publisher, John Wiley and Son, of New York.

A TEMPERATURE model, the second of its kind,[1] has recently been completed by Mr. Eugene Van Cleef, of Chicago. Based upon the data for the period 1890 to 1910, inclusive, it shows in relief the average hourly temperatures for that city. Of plaster-of-paris construction, it is two feet long and one foot wide. Vertical lines at inch intervals are drawn upon the two narrow sides to represent the months of the year, while similar lines drawn upon the other two sides represent the twenty-four hours of the day. The vertical dimension of each point upon the upper surface of the model represents temperature, each sixteenth of an inch representing one degree, the base being zero degrees Fahrenheit. The upper surface is anticlinal, and is colored to show the four seasons of the year. The model is instructive in many ways, the more striking features shown consisting of (1) the diurnal periodicity of temperature, (2) the change in the occurrence of the daily minimum temperature from about 6 A.M. during winter to 4:30 A.M. in summer, (3) the change in the occurrence of the maximum temperature of the day from about 3 P.M. in winter to about 1 P.M. in summer, and (4) the more rapid increase of temperature from spring to summer than the decrease from autumn to winter.

IN the neglected field of phenological climatology a noteworthy contribution has been made by Dr. E. Vanderlinden in his "Étude sur les phénomènes Périodiques de la Végétation dans leurs Rapports avec la Variations climatiques." The latter describes the results of a study of the relation between climate and the flowering-date of thirty-nine plants, as observed at the Royal Observatory gardens in the suburbs of Brussels, during the fourteen years, 1896 to 1909, inclusive. Though the observer was the same throughout the period, all of the plants were not observed each year. The first appearance of the stamens was taken as a basis, since leaves and seeds develop irregularly. When possible, artificial conditions were produced to verify conclusions based upon the observations of the effects of similar natural conditions. The effect upon the flowering date of a plant by departures from the mean of the various meteorological elements affecting its growth was the real object of the study. Rainfall and atmospheric humidity had less effect in this respect than is generally supposed to be the case. Radiation, too, especially during the spring months, is comparatively unimportant. By far the most effective factor in determining the time of florescence is the temperature, though its importance varies with the different stages of the plant's life. Varieties accustomed to mature at about the same time are affected

[1] See SCIENCE, Vol. XXXI., No. 807, p. 954.

similarly by departures in the average weather conditions. Though the approximate date of flowering is determined by heredity, the weather conditions of the preceding season, when the seeds are maturing, have no effect. When the flowering stage is delayed because of unfavorable conditions, a change to more favorable weather will bring out the flowers with a less amount of "accumulated temperature" than otherwise. In general, Dr. Vanderlinden concludes that temperature and insolation outweigh all other climatic factors in the development of the plant up to florescence.

Having been successful in the recovery of sounding-balloons previously sent up at Omaha, Neb., the United States Weather Bureau again used this station as a base of operations in a series of daily ascensions from February 7 to March 3. As it is necessary to recover the instrument carried by this form of balloon in order to get the desired record, the starting point must be well inland, as the prevailing wind aloft invariably blows the balloons eastward. At Mount Weather Observatory, which is unsuitably located for this particular work, pilot balloons have been used since March 1 to supplement the kite flights on the days set apart for international cooperation in aerological exploration. No attempt is made to recover these balloons, as they carry no instruments. By observing them with transit-instruments until they disappear, the velocity and the direction of the wind are obtained. They have been used successfully for this purpose at Blue Hill Observatory since 1909.

Though it has generally been supposed that the rain gauge was invented by Castelli in the early part of the seventeenth century, recent discoveries seem to indicate that it was in use in Korea at a much earlier date. In Volume I. of the "Scientific Memoirs of the Korean Meteorological Observatory," Dr. Y. Wada, the director of the newly established weather service of that country, states that in 1442 King Sejo had a cylindrical bronze gauge, about 12 inches high and 5 inches in diameter, in which the depth of the water was measured after each occurrence of precipitation. In one which he has found, the cylinder stood in a depression in a boulder upon the sides of which an inscription gave the year and stated the purpose of the gauge. Though similar instruments were later used in other parts of the same country, Dr. Wada has been unable to recover any of the records, which were doubtless preserved for a time. The latter would be exceedingly interesting and valuable at present in furnishing data concerning climatic changes. Korea is a land of deficient rainfall now, and the special efforts made to measure it five centuries ago would seem to indicate that it was an important factor in the welfare of the people even at that early date, suggesting similar conditions then.

"Dynamic Meteorology and Hydrography," by Professor V. Bjerknes, of the University of Christiania, and various collaborators, has recently been publshed by the Carnegie Institution of Washington. The greater part of the volume consists of exhaustive discussions, in nine chapters, of the more important problems in statics. Diagrams, tables and mathematical demonstrations are generously employed to make clear some of the complex problems treated. The remainder of the book consists of hydrographic and meteorological tables. On account of the abstruse nature of the matters discussed, not many will appreciate the value of the work, but advanced students will doubtless find it a notable contribution.

Two interesting discussions of the cold of winter anticyclones are found in *Symons's Meteorological Magazine*. In the March number Mr. W. H. Dines states that according to the Greenwich records for the fifty years, 1841 to 1890, inclusive, a considerably larger number of days of frost occurred when the mean barometric pressure was below 29.80 inches than when it was above 30.20 inches. During that period nearly every frost noted for severity or length occurred in the low pressure series. The statement concerning the supposed cold in winter anticyclones in many text-books he says is not substantiated by evidence, and he suggests that the idea "may

have come from the mistaken notion that an anticyclone brought down air from the upper strata, and therefore ought to be cold. The descending air does occur, but the temperature during an anticyclone a few hundred feet high is unduly warm." In the April number Dr. J. Hann points out the fact that it is not the absolute height of the barometer that is determinative in locating anticyclones, but rather the relative height of the barometer compared with that of the surrounding districts. He maintains that the center of an anticyclonic area is cold in winter, "a focus of cold"—an opinion supported by the investigations of Hildebrandsson on temperatures in cyclones and anticyclones. "The cold arises in winter in anticyclonic regions as a result of radiation favored, in a high degree, by the clear skies and the dry air of the anticyclonic center. One can say definitely that the cooling of the earth in the winter half-year is accomplished mainly in the anticyclonic areas of the land surface. Nocturnal radiation is very intense in the dry air, especially when the surface of the ground is covered with snow." The extremes of the winter months in central Europe show no constant relation to the variations of pressure in central Europe itself, as the "focus of cold" is usually at the center of a persistent continental anticyclone to the northeast. Only in exceptional cases is central Europe itself the seat of this center, and when it is, abnormally cold weather is experienced. As the British Isles usually remain on the western side of the European anticyclone, and thus have southerly and southeasterly winds with high barometer, it follows that high temperatures quite often accompany the high barometer. At the same time, however, it is cold on the continent in the center of the European anticyclone.

ANDREW H. PALMER
BLUE HILL OBSERVATORY,
April 25, 1911

THE SOIL, A LIVING THING

FOR many years the fertility of the soil was sought in the chemical substances which analysis proved to be essential to plants and which could be exhausted from the soil by the continual growth of a single crop upon it. To restore the fertility of the soil, it was necessary only to restore the ingredients necessary to keep a plant in a productive condition. Fertilizers were applied which were known to contain the most important materials of plant food and in an available form. Even to-day, there are opposing camps of plant physiologists. One set holds to the principles, first clearly enunciated by Liebig, that the chemical condition of the soil is the most influential factor in the productivity of the garden, or farm. The other group consider that the physical condition of the soil influences the tilth. This school teaches that all agricultural soils contain sufficient quantities of the essential mineral plant foods for many years to come. Recently a more advanced position has been taken by some students of the soil, when they claim that the loss of fertility of many long cropped soils is due to the accumulation of toxic bodies, the accumulated excreta of plants that may have been grown without proper rotation. The true theory of soil fertility will probably be found to be one which will combine all of these theories with another one, which I believe must also be considered in reaching a satisfactory conclusion as to the relation existing between crops and the soil in which they grow.

The theory is one which considers that the soil is a living thing apart from its chemical or physical structure, that in the reaction between the living soil and the growing plant is the true explanation of soil fertility. A fertile soil is a live one. An infertile soil is a dead one. Contrast the soil which is filled with organic matter (humus) and in which numberless fungous, bacterial and protozoan organisms are at work with a mass of clay or sand without such organic material and associated living organisms. The one soil is fertile, because the organisms in the soil react favorably upon each other, the other soil is infertile, because the organisms present in this soil are antagonistic. Recent investiga-

tion has pointed the way along which future research on soils must proceed and some of this instructive work may be reviewed here briefly and in a sequence which suggests the orderly manner in which effect follows cause.

Harter[1] in a paper entitled the "Starch Content of Leaves dropped in Autumn" has shown that the well-established belief that autumn leaves contain very little carbohydrate in the form of starch and sugar is erroneous, for during the summer of 1909, he undertook to trace the change taking place in the amount of starch formed in the leaves of *Liquidambar styraciflua* at different periods, viz., August 17, September 15, October 23 and October 28. On October 28, the leaves were collected which had fallen recently from the tree. The starch in the leaves collected at the different dates was determined quantitatively and was found to be as follows: August 17, 10.91 per cent.; September 15, 10.33 per cent.; October 23, 11.47 per cent. and October 28, 10.79 per cent., based on the dry weight of the material. Since so much starch was found in the fallen leaves of the sweet gum similar material was collected from several other plants and the starch determined as above. The amount of substances in the leaves capable of reducing the copper in Fehling's solution, as determined by the above method, are shown in the table:

	Per Cent
Liquidambar styraciflua	10.79
Gingko biloba	6.32
Platanus orientalis	11.84
Platanus occidentalis	9.89
Styrax americana	5.91
Magnolia obovata	7.19
Quercus pedunculata	14.54
Elæagnus umbellata	10.24

The thought suggested to me after reading the results of Harter's work was one which considered the final disposition of the starch in the fallen leaves. Is this starch disintegrated, or is it changed into a form by which it can be utilized by the roots of forest plants and by the organisms of the soil? To answer this question, I would call attention to the studies of a graduate student of mine, who in a recent piece of work on "Bacteria and other Fungi in Relation to the Soil" has discovered the ultimate destiny of this carbohydrate material. Dr. Rivas[2] by a detailed analysis of the bacterial content of virgin forest soils has shown that the largest number of bacteria are found during October, and the least number during the winter months. He finds that the forest soils contain bacteria which produce enzymes capable of fermenting the carbohydrates, as shown in the following tabulation of his results, which shows the relative proportion of the different ferments produced by the species isolated.

	Per Cent.
1. Diastatic ferment acting on starch, found in 24 cultures	60.0
2. Inverting ferments, inverting starch or saccharose into glucose found in 29 cultures	72.5
(A) Inverting starch into glucose found in 22 cultures	55.0
(B) Inverting saccharose into glucose found in 14 cultures	35.5

The presence of these organisms in the soil clearly points to the fact not previously considered in the study of forest soils, that the starch found in autumn leaves can be converted directly by such soil organisms into glucose, and it is probable that this sugar is directly absorbed by the roots of higher plants (a fact not previously suspected), either by the root hairs, or by means of the mycorhiza found abundantly on the roots of many forest trees. Such sugar is also utilized by non-chlorophylless plants, saprophytic fungi (*Agaricus*), and flowering plants (*Monotropa*), for it has long been known these plants can absorb the whole of their organic food (including the soluble carbohydrates) from the humus and that the various mycorhiza living in commensalism with the roots of phanerogams are probably of considerable importance in render-

[1] *The Plant World*, 13: 144–147, June, 1910.

[2] "Contributions from the Botanical Laboratory of the University of Pennsylvania," III., 243–274.

ing the humus available. Saida[3] has shown that the parasitic fungus *Phoma betæ* can fix nitrogen in the presence of cane sugar, as follows:

Substances Added to a Nutrient Salt Solution	Cane Sugar in Grams	Fixation of N in Milligrams
Cane sugar.....	5	.7393
Cane sugar.....	17	1.1828
Cane sugar (+$(NH_4)_2CO_3$ trace)	5	1.1828
Cane sugar (+$(NH_4)_2CO_3$ trace)	10	1.7742
Cane sugar (+$(NH_4)_2CO_3$ trace)	20	3.5484
Cane sugar (+$(NH_4)_2CO_3$ trace)	30	6.2097

More recently Ternetz[4] has isolated five endophytic mycorhizal fungi from certain Ericaceæ, all of which have been found to belong to the genus *Phoma.* Three of these organisms, *Phoma radicis oxycocci, Phoma radicis vaccinii* and *Phoma radicis andromedæ,* have shown a well-developed capacity for nitrogen fixation in culture, these three mentioned working even more economically than *Azotobacter chroococcum,* the amount of nitrogen fixation in milligrams per gram of dextrose being under the conditions of culture, respectively 22.14, 18.08, 10.92 and 10.66 for the four organisms mentioned.

With these discoveries in view, we can briefly summarize. The starch in fallen autumn leaves is converted by certain forest soil bacteria into glucose. This glucose is utilized directly by the roots of forest trees, by various saprophytic plants and by the mycorhiza, which by the aid of the glucose are enabled to fix considerable amounts of nitrogen. That the soil is the seat of other activities of as much importance to growing plants, as the above, is proved by the presence of the nitrifying and denitrifying bacteria, of the bacteria that produce the root nodules of the Leguminosæ, of such organisms as *Clostridium pastorianum, Bacillus mycoides, B. ellenbachensis, Azotobacter chroococcum, A. Vinelandii* and the hyphæ of numerous saprophytic fungi, various putrefactive bacteria, which perform their rôle in making the soil the fit habitation of the higher flowering plants, producing the tilth or "Bodengare" of the Germans. So too earthworms, insect larvæ, ants and burrowing animals assist in the task of aerating and mixing the surface layers of the soil. It is also evident that the production of toxic excretions by the roots of plants is undoubtedly a factor of importance in soil fertility. Following out a clue which the partial sterilization of the soil by chemicals or by steam gave, it was discovered that the bacteria which are useful in ammonia-making increased four-fold after such treatment, suggesting the presence in the soil of some agent which held them in check. After much painstaking study, it was discovered[5] that the soil contained a living protozoon (*Pleurotricha*), which preyed upon the useful organisms, and that the heat and chemicals either destroyed these larger unicellular animals, or inhibited their activity. It can be said, therefore, that the fertility of the soil is largely a biological one, as well as dependent upon the physical, chemical and toxic condition of the surface layers. That the productivity of some soils is due to biological rather than to physical and chemical characteristics is illustrated by the attempts made to reforest Denmark. The peninsula of Jutland was covered originally by forests, but these were destroyed, until by the year 1500 the country had been transformed into a barren heath and sand dunes. At various times attempts were made to reforest these heaths but the results were disappointing until Col. E. Delgar[6] solved the problem. Spruce trees (*Picea alba, P. excelsa*), if planted alone did not thrive, but became sickly. The cause of this irregularity in the growth of spruce was thought to be local conditions of the soil, but scientific investigation of such soils did not reveal any

[3] "Ueber Assimilation freien Stickstoffs durch Schimmelpilze," *Ber. d. deutsch Bot. Ges.,* 19: 107–115, 1901.

[4] Duggar, B. M., "Fungous Diseases of Plants," p. 74; Ternetz, Charlotte, "Ueber die Assimilation des atmosphärischen Stickstoffes durch Pilze," *Jahrb. f. wiss. Bot.,* 44: 353–408.

[5] Hall, A. D., "The Soil as a Battleground," *Harper's Magazine,* October, 1910, pp. 680–687.

[6] Hovgaard, William, "The Reforestation of Denmark," *American Forestry,* XVI., 525–529, September, 1910.

difference in the physical or chemical composition of the soil. It was found, however, that the mountain pine (*Pinus montana*) acted as a nurse to spruce trees planted in its vicinity. In the same soil where spruce if planted alone would remain backward, it would if planted close to a mountain pine grow up vigorously. After some years of trial, it was found that the pine would hamper the growth of the spruce, and so it was cut down at an early age. It was discovered then that even if the mountain pine was cut down at an early age, it imparted to the adjacent spruce trees the ability to grow. The phenomenon is not understood, but it is supposed that the roots of the mountain pine are inhabited by some mycorhiza which produces the nitrogen necessary for the growth of trees and that this organism is transferred to roots of the surrounding spruce trees. Once this infection has taken place, the presence of the mountain pine is no longer necessary and it is usually cut down. Clearly this is a biological relationship.

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SPECIAL ARTICLES

OOSPORES OF POTATO BLIGHT

The potato blight fungus, *Phytophthora infestans,* has attracted more attention from botanists than almost any other fungus. The reasons for this are that under certain climatic conditions it causes sudden and widespread destruction of potato fields, and also that, though its life history has been carefully studied, the sexual or oospore stage has never been surely found. Berkeley, who was one of the earliest investigators to have a rational view of the cause of the epidemic of 1845, wrote at the time as follows:

> Few subjects have attracted more attention or have been more variously canvassed than the malady with which potatoes have been almost universally visited during the autumn of 1845. The press has teemed with notices the most contradictory; the attention of scientific men in every direction has been engaged by it; and three, at least, of the principal governments of Europe have issued commissions to examine into its etiology, and to discover, if possible, a remedy.

In 1875–76, at a time of considerable devastations of potato crops in Europe by the fungus, DeBary was employed by the Royal Agricultural Society of England to further investigate this fungus, while at about the same time Worthington G. Smith was engaged in similar work for the Royal Horticultural Society. As the result of their endeavors, considerable was learned concerning the life history of the fungus. Smith claimed to have found the oospores in the infested leaves and the old sets in great abundance, and was awarded a gold medal by the Royal Horticultural Society for his work. These bodies had been observed as early as 1845 by Rayer, Montagne and Berkeley. DeBary did not succeed in finding what he considered oospores of this fungus, and disputed Smith's claim with such good reasons that botanists generally believe that the oospores have never been discovered, though once or twice since investigators have claimed, without much conviction, to have found immature oogonia.

At the time of the controversy DeBary said:

> Ever since the oospores of a *Peronospora* were discovered, innumerable researches have been made for those of *Phytophthora.* I have myself looked for them for fifteen years, and on every opportunity have searched for them in the stalks, leaves, flowers, fruit and tubers of the potato. In July of the present year (1875), when the fungus appeared in this district in sad abundance, I obtained a very large amount of material for study, and at the same time secured the kindly assistance of two botanists experienced in researches of this kind, Dr. Rostafinski and Dr. Stahl. But again only negative results were arrived at. . . . That they will be regularly found somewhere or other is assured, for our knowledge of the habits of numerous allied fungi make this more than probable.

Smith deposited slides of his oospores with the British Museum. Concerning these Massee some time ago wrote me:

> I have very carefully examined W. G. Smith's type slide preparation, and am positively certain that the so-called oospores are nothing more than

the globose, thick-walled chlamydospores belonging to a Fusarium.

In a discussion following the Jones and Lutman paper at the American Association for the Advancement of Science meeting at Boston last year, Güssow said that he had seen these slides, and that the oospores much resembled the bodies that Jones and Lutman had obtained in their artificial cultures. The writer has not seen these slides, though he tried to obtain examples of the oospores from Smith a few years ago. Smith wrote at that time:

> No doubt you know that the oospores became a kind of political subject—oospores of *P. infestans* or not oospores of *P. infestans?*—and I had no wish to go on. Botanists and popular writers followed what they took to be the safer authority, just as Saccardo has done; this is right enough in a way.

While we have not seen these slides, on every possible occasion during the eight years that we have been studying this fungus, we have looked for oospores in the leaves and tubers under the conditions described by Smith. While we have never found spores that satisfied us that they were the potato blight oospores, we have found oospore-like bodies, both of animal and fungous origin, that might be mistaken for such, and possibly might be some of those bodies described by Smith. We have seen Smith's drawings, and his photomicrographs published in the *Quarterly Journal of Microscopical Science,* Vol. 15, in 1875, and the drawings of Montagne, published by Berkeley in the *Journal of the Horticultural Society,* Volume 1, in 1846, these latter being considered by Smith to represent the same thing he described as the oospores. None of these impress us as being the same as the true oospores that we have obtained in cultures. The only figures that at all show a resemblance are Figs. 134 to 136 in Smith's book on "Diseases of Field and Garden Crops," published in 1884. We are inclined to believe that these botanists had a variety of things under consideration, and while it is quite doubtful if any of them were the oospores of potato blight, we do not wish to make a positive assertion without seeing the original preparations.

In 1904 we first began to study the potato blight in artificial cultures. So far as we know, we were the first to make such cultures in this country, or at least to publish notes on them,[1] but in looking up the literature at the time, it was found that two French botanists, Matruchot and Molliard, had secured cultures even earlier. Their results, published in 1900 and 1903, were similar to those we had obtained; viz., the fungus was grown in certain media with fair success, but no oospores appeared, though we did very rarely find curious-shaped threads that might indicate futile attempts to form oogonia.

At the Baltimore meeting of the American Association for the Advancement of Science, in December, 1908, Jones and Giddings gave a paper[2] in which they described these curiously shaped threads which had appeared with more or less frequency in stab cultures of a specially prepared potato-gelatin medium that they used. Jones was inclined to believe that they were attempts at oogonial formation, though there were no indications of antheridia or oospores. At the same meeting the writer[3] described a special medium, Lima bean juice agar, on which the potato blight grew with far greater vigor than on any medium yet tried, so that its continued cultivation was as easy as that of any parasitic fungus. On this medium, however, no oospores appeared, and very rarely even the curious-shaped threads, though when *Phytophthora Phaseoli,* a near relative, was grown on it, oospores appeared in profusion.

At the Boston meeting of the American Association for the Advancement of Science, Jones and Lutman gave a second paper[4] in which they further discussed these curious bodies that appeared in their cultures. Though not stating positively that these bodies were of the nature of oogonia, they were inclined to consider them as resting spores. While much

[1] Conn. Agr. Expt. Sta. Rept., 1905.
[2] SCIENCE, XXIX., 271, February 12, 1909.
[3] Conn. Agr. Expt. Sta. Rept., 898, 1908.
[4] SCIENCE, XXX., 813, December 3, 1909.

more successful in producing these bodies than previously, due in part to the use of the lima bean medium in a modified form, and while these bodies showed a still greater modification toward the oogonial type, they did not succeed in producing in their cultures any bodies of the nature of antheridia.

During the past year the writer, with the aid of his assistant, Mr. E. M. Stoddard, has made still further tests with four strains of potato blight obtained from different sources, and with two of these (really one, as the other traces back to the same potatoes one season later) has obtained results far beyond anything yet reported. These results were primarily due to the use of a new medium, which gave us for the first time very definite attempts at oospore formation, and with a certain modification of this medium *absolutely perfect oogonia, antheridia and even oospores have been obtained.* We have not been successful, as yet, in producing the oogonia in cultures in anything like the abundance of those of *Phytophthora Phaseoli* and *Phytophthora cactorum* in the same medium, and very few of the oogonia produce even partially mature oospores, but of their nature there can be absolutely no doubt. Whether or not we can perfect their formation in greater abundance remains to be seen, but recently, from an unusually good culture, a temporary slide preparation showed over a hundred of these oogonia, mostly without oospores or with immature ones; whereas last March the most we could find in similar slides were half a dozen or less.

From the results of our recent investigation there is no doubt that the curious threads and bodies that Jones, and the writer to a much less extent, previously obtained, were attempts at the formation of oogonia. We should judge, however, that Jones's cultural media, except for one particular, were not suited to perfect these bodies further, and that the excretory markings he obtained on the cell walls were largely abnormal. From my investigations it can be stated that the oogonia of the potato blight are thick-walled, with a more or less roughened or ornamented external coat, due to excretory thickening of the original wall, and are tinted more or less a chestnut brown. The oospores are moderately thick-walled, smooth and colorless. The oogonia are of a quite different type from those of both *P. Phaseoli* and *P. cactorum,* which are similar. The oogonia and oospores of these two are somewhat smaller than those of *P. infestans,* but the chief difference is their smooth, hyaline, thin-walled oogonia.

Not only has the writer obtained the oospores of *P. infestans* in pure cultures, but he has also succeeded in raising what he considers crosses of this fungus with both *P. Phaseoli* and *P. cactorum* by inoculating a test-tube of the special medium with *P. infestans* at the top and one or the other of these two species below. With the growth of the two colonies together there appear in the vicinity of the *P. infestans* colony not only the oospores of the other fungus but also oospores of the *P. infestans* type. These oospores of the *P. infestans* type so far appear only rarely in the crosses with *P. cactorum,* which, however, have only recently been made. In the crosses with *P. Phaseoli* the oospores of the *P. infestans* type are more abundant than they have ever yet appeared under the most favorable conditions in pure cultures of *P. infestans,* and many of them produced perfect oospores. On the whole the oogonia and oospores appear to be somewhat larger and less deeply tinted than those from the pure cultures of *P. infestans.* Crosses between *P. infestans* and *P. Phaseoli* made last March still continue to produce oospores of the *infestans* type, not usually as abundant as those of the *Phaseoli* type, however, though these cultures have been renewed six times since their original crossing. These descendants are not from the oospores, since they never germinate in the cultures.

From the data at hand it looks as though there were not two strains (male and female) of the potato blight, as we suggested some time ago, but that the potato fungus had largely lost its power to reproduce itself sexually. This loss may have come about by propagating it year after year asexually

through its hibernating mycelium in the potato tubers, just as the potato itself has largely lost its power to reproduce sexually through the formation of seeds. This loss of sexual power is shown in different degrees by the different strains of the fungus in artificial cultures. The fungus seems to lose first its power of producing antheridia and then of producing oogonia. Under favorable conditions attempts to form oogonia first appear, and under still more favorable conditions the antheridia are produced, and with the formation of these the oospores also appear in more or less perfect form.

A further discussion of this subject, with photomicrographs of the sexual stages as we have gradually developed them, will appear in the next report of the Connecticut Agricultural Experiment Station.

G. P. CLINTON

NEW HAVEN, CONN.,
December 20, 1910

A POSSIBLE LINE OF DESCENT OF THE GOBIOID FISHES

Indicating the doubt existing as to the relationship of the gobies are the several different positions assigned to them in the schemes of classification suggested from time to time by different authors. Without attempting anything like an exhaustive survey of the disposition of the group by different authorities its treatment by a few of them may form an introduction to the suggestions of relationship in the following lines.

Dr. Gill, in his "Arrangement of the Families of Fishes,"[1] places the superfamilies Gobioidea and Cottoidea in adjoining groups. But in his later arrangement[2] he has several families interposed between the Gobiidæ and Cottidæ, as the Batrachidæ, the Uranoscopidæ, the Trachinidæ, the Malacanthidæ and others.

Dr. Jordan, in his "Guide to the Study of Fishes,"[3] has placed the gobies near the cottoid fishes with the following remark: "The great family of Gobiidæ, having no near relations among the spiny-rayed fishes, may be here treated as forming a distinct suborder."

Dr. Boulenger, in the Cambridge Natural History,[4] places the Gobiidæ between the Kurtidæ and Echeneididæ, and expresses the opinion that the gobies "are not very remote from the Perciformes, and may have evolved out of a type not very different from the Percidæ."

Mr. Regan, in his classification of the teleostean fishes,[5] has placed the suborder Gobioidea between the Blennoidea and the Kurtoidei.

Recently while examining the skeleton of *Dormitator maculatus,* a large goby from the warm waters of the American Pacific and Atlantic, I was impressed with the similarity of its shoulder girdle with that of the family Cottidæ and certain other cottoid or mail-cheeked fishes. In light of the fact that there is otherwise very little in the anatomy of the gobies that might show their line of descent, I wondered that the line from some ancestor of the Cottidæ had not been long ago suggested, more especially as there seems to be little reason why such relationship should not exist.

The similarity of the shoulder girdles of these families has long been known. As early as 1865 Dr. Gagenbaur published a picture of the shoulder girdles of a gobioid and a cottoid fish side by side in the second part of his "Untersuchungen zur Vergleichenden Anatomie der Wirbelthiere."[6]

The condition of the shoulder girdle in the Cottidæ and Gobiidæ is as follows: The coracoid elements and the actinosts are arranged in a continuous row on the posterior edge of the clavicle; the hypercoracoid above, next the actinosts, and ending below with the hypocoracoid—the actinosts attached directly with the clavicle, and separating the coracoid elements widely from each other. In the typical condition—the condition in the great majority of fishes—the coracoid elements are broadly attached to each other, and the actinosts are attached to their posterior edges remote from the clavicle.

[1] "Smith. Miss. Col.," 1872.
[2] *Mem. Nat. Acad. Sci.,* Vol. VI., pp. 127–138.
[3] Henry Holt and Co., 1905.
[4] Macmillan and Co., 1904.
[5] *Ann. Mag. Nat. Hist.,* Ser. 8, Vol. III., 1909.
[6] *Hemitripterus acadianus* and *Gobius guttatus,* Taf. VII., figs. 8 and 9.

The fact that all of the mail-cheeked fishes do not have the coracoid elements separated by the actinosts is not an argument in disfavor of the relationship of the Gobiidæ to the Cottidæ, because the mail-cheeked fishes with the typical shoulder girdle (such as the Scorpænidæ) were, of course, the ancestors of the Cottidæ. From the Cottidæ came the Liparidæ and the Cyclopteryidæ, as Dr. Gill long ago pointed out.[1]

It does not seem improbable that the gobies may have come from some ancestor—probably scale-covered—of the Cottidæ in which the shoulder girdle had become differentiated. Further, it is not altogether improbable that this ancestor might also have been from somewhere along the line leading towards the Cyclopteryidæ and the Liparidæ; some form in which the ventrals had just become attached to each other, much as in most of the gobies of to-day. From this the sucking disk of the Liparidæ and Cyclopteryidæ could have developed. In considering this supposition, of course, we could only explain the gobies with separate ventrals by the separation being secondary. The gobies further resemble the last two families in having no myodome to the cranium.

It is conceded, certainly, that the family Gobiidæ is not very close to the Cottidæ, they having lost the suborbital stay to the preoperculum and undergone other changes, and no modification of the suborders containing these two families is suggested. The character of the shoulder girdle seems to be the most significant character in showing a possible line of descent of the gobies, and it is suggested in light of it that the group be placed in close relationship with the mail-cheeked fishes in works involving classification. With this question in mind the gobies should, of course, be studied in detail.

Edwin Chapin Starks

CARCHARIAS BORNEENSIS AND BARBUS ELONGATUS, AS PREOCCUPIED NAMES

In the *Philippine Journal of Science*, Vol. V, No. 4, Section D, October, 1910, p. 263, Pl. 1, Mr. Alvin Seale describes, as new, "*Charcharias borneensis.*" This is preoccupied by *Carcharias* (*Prionodon*) *borneensis* Bleeker, *Act. Soc. Sci. Ind.-Neerl.* (Borneo 12), V, 1858–59, p. 8.

In the same journal Mr. Seale also describes, as new, *Barbus elongatus*, on p. 265, illustrated on Pl. 2 as Fig. 1. This is preoccupied by *Barbus elongatus* Rüppell, Mus. Senckenb., II, 1837, p. 11, Pl. 2, Fig. 1.

Henry W. Fowler

Academy of Natural Sciences,
Philadelphia, Pa.,
February 9, 1911

[1] *Proc. U. S. Nat. Mus.*, Vol. XIII., 1890.

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 693d meeting was held on April 8, 1911, President Day in the chair. Three papers were read.

Mechanical Forces on an Electrical Conductor: Dr. Frank Wenner, of the Bureau of Standards.

Starting with the equation for the electromotive forces in an inductive circuit the speaker showed how it follows under certain conditions that a current through a conductor causes forces such as to require a tension in the conductor to maintain equilibrium, that is, the forces tend to increase the length of the conductor. It also follows that under other conditions the forces are such as to tend to decrease the length of the conductor. Under most conditions the force on an element of the conductor near the surface is such as to tend to crowd it toward the center.

It was also stated that it is possible that a current in a conductor causes forces other than those due to electro-magnetic and electrostatic actions, the former only having been considered by the speaker. So far, however, no one has shown the presence of any such additional force.

The Completion of the Texas-California Arc of Primary Triangulation: Mr. Wm. Bowie, of the Coast and Geodetic Survey.

Three grades of triangulation are recognized: primary, secondary and tertiary; and the grade depends upon the accuracy of the angle and length measurements rather than upon the length of line between pairs of stations.

The primary work is extended in long arcs over

the area of a country to furnish control for the detailed operations. The tertiary is used for the immediate control of detailed topographic, boundary and other surveys, while the secondary triangulation is mainly for the purpose of connecting the detached tertiary work with the primary schemes.

Owing to the difference which must exist at every station between the geodetic position and the corresponding astronomic position, it is necessary to adopt a mean position called a geodetic datum upon which to reckon geographic positions over the entire country. It is the principal object of the primary triangulation to carry standard positions by a connected net to the remotest portions of the area.

An incidental purpose of triangulation, and especially of the primary, is to furnish means for determining the shape and size of the earth.

In the two recent investigations of the figure of the earth by Mr. John F. Hayford, while he was inspector of geodetic work and chief of the computing division in the Coast and Geodetic Survey, he applied Pratt's hypothesis of isostasy and he stated that the application of this theory nearly doubled the accuracy of the results.

Including about 2,000 miles by the Lake Survey, there are now approximately 11,000 miles of primary triangulation in the United States. Recently about 400 miles have been added each year. The latest addition is the Texas-California triangulation, an arc of over 1,200 miles in length. It extends from the 98th meridian triangulation in central Texas to the Pacific coast arc in the vicinity of San Diego. It carries standard positions into an area badly in need of control and adds very valuable data for use in a future investigation of the figure of the earth.

The probable errors of the observed directions are not available, as the office computations have not yet been made, but we may get a measure of the accuracy of the work by the size of the errors of closure of the triangles. The average closing error is 0.9 second of arc, and the maximum error is very little more than 3 seconds. This makes the accuracy equal to the average of the best half of the work previously done in the United States.

The observations for horizontal measures were made entirely on heliotropes or on signal lamps. No serious difficulty was encountered in observing over even the longest lines under average conditions. The longest line was 127 miles in length. Some of the heliotropes had reflectors 4 and 8 inches square but most of the reflectors were only 2½ inches in diameter. The signal lamps burned acetylene gas. They were the commercial automobile headlights, modified for use on a stand erected over the station.

Some years ago it was believed that a great many observations were necessary to get an accuracy represented by an average closing error of one second and that the observations should be made on a number of different days. In recent years only sixteen positions are used, making 32 pointings on each object. All the horizontal observations at each of many stations have been made in a single day without materially affecting the accuracy. In fact, the average accuracy of the work done under the present methods is greater than the average accuracy of the work previously done.

It has been found that the sun effect on the towers, in causing twist, is very slight with the present type of tower, and that the effect, if any, is practically eliminated from the results by the system (always employed) of having a determination depend upon observations made while revolving the instrument clockwise and then in the reverse direction immediately afterwards.

The instrument had one horizontal wire and two vertical ones which were 20″ apart. It is not necessary for the image to be absolutely stationary for, with practise, one can place the cross wires close to the mean position of the image, even though the object may subtend an angle of more than 20″ and move 10″ to each side of the mean position. Observations made under this condition seem to have about the average accuracy.

Where the country is flat and the line close to the intervening land the wind tends to cause a distortion of the image. It sometimes appears to flare to one side, the flaring being away from what seems to be the nucleus or center of the image. In nearly every case where an asymmetrical image is observed the flaring seems to be with the wind. Under such a condition it is difficult to make satisfactory observations. If the flaring portion of the image is given equal weight with the nucleus a constant error is introduced, while if this flaring part is given no consideration a constant error of the opposite sign is made. Such an image is a severe test of the skill of the observer.

A remarkable case of lateral refraction was encountered on the twenty-mile line joining stations Clayton and Kennard, in Texas. This line passed very close to the west slope of a flat-topped hill about two and a half miles from Clayton. Observations made during several days at Clayton

on Kennard while the wind was blowing from the slope across the line were very unsatisfactory. When observations were made over the line with the wind blowing across it towards the slope of the hill, they were of the required degree of accuracy. The total range in the values for the several observing periods for this direction was about 8″ of arc. During each observing period the range of the values for the sixteen pointings was small. It is believed that the air blown from the hill across the line was of a different temperature and was the cause of the lateral refraction.

The large errors in the observed directions of primary triangulation seem to be due to three principal causes. First, to the asymmetrical image of the light or heliotrope caused by wind when the line is low. Second, to lateral refraction, caused by a line passing close to a hillside or mountainside with the wind blowing from the slope across the line. Third, to the very unsteady lights when the instrument is low with the line passing close to the ground near the station. The first two causes produce constant errors, that is, each of the 32 measures is affected in the same direction. The last cause makes large accidental errors.

The Modern Potentiometer: Dr. W. P. White, of the Geophysical Laboratory of the Carnegie Institution of Washington.

For many purposes it is desirable to avoid the slide wire. The construction of potentiometers of wide range in which only switches are used formerly presented difficulties, which have now been overcome. The modern all-switch potentiometer is characterized by three features: (1) the resistance is low, yet the switch contacts introduce no error; (2) the thermo-electromotive forces at the switch contact and elsewhere must not cause variations in the reading; (3) the change of setting must not change the resistance of the galvanometer circuit; this in order that the partial deflection method may be employed. These three characteristics can not only be readily secured, but can be obtained in a number of different ways, so that three different types of instrument possessing them are now possible.

The main point of difference practically is concerned with the question whether certain switch contacts shall come in the battery circuit or in the galvanometer circuit. If they are in the battery circuit, much more care must be given to keep their resistance low, but this arrangement is best for reducing the thermoelectro forces. With the contacts in the galvanometer circuit, their resistance is unimportant, and the instrument therefore requires less care and attention; the thermo-electric forces can be practically avoided by proper switch construction, so that this arrangement seems preferable in a majority of cases.

(The abstracts of the second and last paper are by their authors.)

R. L. Faris,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 383d regular meeting was held April 1 in the lecture hall of the Cosmos Club with President David White in the chair and about a hundred persons present.

Under the heading brief notes and exhibition of specimens, F. V. Coville showed a pot of trailing arbutus (*Epigæa repens*) in full bloom. The plant had been grown in the greenhouse from the seed, and ooth foliage and blossoms were superior to those commonly found wild.

The following communications were presented:

A Day in the Galapagos Islands: William Edwin Safford.[1]

The arboreous cereus of Charles Island has never been adequately described. It was said by Darwin to resemble *Cereus peruvianus* and compared by Engelmann with *Cereus multiangularis*. It is quite distinct from both these species. The well-known *C. peruvianus* has only six to eight longitudinal ribs, while the Charles Island Cereus has sixteen to eighteen ribs. It is doubtful whether *C. multiangularis* is ever arboreous. Weber has described the Charles Island cereus under two names: *Cereus thouarsii*, which he characterizes as a columnar cereus with superimposed joints and pleasantly acidulous purplish-red, plum-like fruit containing soft white pulp and numerous small black seeds; *Cereus galapagensis*, as a plant resembling the arboreous cerei of South America, "with elevated angular stems exceeding the surrounding vegetation." Both of these descriptions apply well to the Charles Island cereus, illustrations of which, in flower, were presented by the author of the paper. The descriptions of both supposed species were published on the same page by Weber, and though *C. galapagensis* may be a preferable name, as it indicates the habitat of the species, *C. thouarsii* precedes it on the page, and must therefore be accepted.

Cereus thouarsii is remarkable for the long slender tube of its funnel-shaped perianth. The

[1] This paper is to be published in *The National Geographical Magazine.*

flowers are borne not near the apex, as in our giant cereus of Arizona, but along the sides of the branches and stems, often growing from areoles of the older or lower joints, solitary, yet often appearing from two or three adjacent areoles. The ripe fruits are very much like the *pitahayas* sold in Mexican markets. They are crowned by the withered perianth.

The joints, appearing in series and separated by abrupt constrictions, are sometimes five or six feet long, shaped like great ears of corn, or like thick-handled ten-pins or indian-clubs, or they are shorter and oval, resembling a series of melons piled one on top of the other, or they are sometimes spheroid, and the branches often form a divarication from one of the globose articulations. From the illustrations presented it is apparent that the arboreous cereus of Chatham Island is identical with that of Charles Island. It is to be regretted that figures of the flowers of Galapagos Cactaceæ are absolutely wanting thus far, though the islands have been repeatedly visited by scientific expeditions. The older specimens of *C. thouarsii* have stout cylindrical trunks covered with bark which splits into longitudinal strips.

The first description of an arboreous cereus growing in the Galapagos is that of the navigator Dampier, who visited the group in 1684. He described it as "a green prickly shrub ten to twelve feet high, as big as a man's leg and full of sharp prickles in thick rows from top to bottom, but without leaf or fruit." Colnett, in 1793, distinguished the cereus from the opuntia observed by him in the Galapagos, calling the first a "torch thistle" and the second a "prickly pear."

Captain David Porter was the first writer to call attention to the differences of the tortoises on the different islands of the Galapagos. His journal of the *Essex* was published twenty years before the visit of the *Beagle*. Figures were presented of two of the living tortoises from the Galapagos now in the National Zoological Park, *Testudo ephippium*, an example of what Captain Porter called the saddle-backed form, and *Testudo vicina* Guenther, with a back of the form likened by Woods Rogers, the old sea-rover, to the top of an old-fashioned hackney coach.

The figure of a fossil species, *Testudo osborniana* Hay, from the Miocene of northeastern Colorado, was also shown, and the question as to the possible connection of the Galapagos group with the main land during some part of the Tertiary age was discussed. The fact recorded by Captain Porter that tortoises thrown overboard from captured vessels remained floating and unharmed for several days, though unable to swim, was cited as bearing upon the point of the possible translation of the ancestors of the tortoises from the continent to the islands by ocean currents.

The paper ended with an account of the writer's visit to a hermit living in a cave in the interior of Charles Island, and of the animals which had become wild on the island, some of which had been caught when young and domesticated by the hermit. An account of the garden cultivated by the hermit was also given.

The Keys, Corals and Coral Reefs of Florida: T. WAYLAND VAUGHAN.

Dr. Vaughan gave a short lecture, illustrated by stereopticon views, on the subjects indicated by the title of his communication. He called attention to the extensive submarine plateau, of which the present land surface of Florida constitutes less than one half, and lies near the eastern margin. He briefly described the course of the 100-fathom curve and the steep declivity from it to the depth of 1,500 and 2,000 fathoms in the Gulf of Mexico, whereas between peninsular Florida and Cuba (except north of Havana) the depths are less than 500 fathoms. Between the northern end of the Bahama bank and the east coast of Florida the depth is somewhat less than 300 fathoms. The course of the 10-fathom curve was traced, and the relations it bears to the great barrier reef of Florida were indicated. The Hawk Channel, which lies between the line of reefs and the keys, the keys, and the bays and sounds between the keys and the mainland, were briefly described. A series of photographic slides were shown to illustrate the topography and geology of the mainland in the vicinity of Miami, and the surface features, including the vegetation, of the entire line of the Florida keys. The geologic formations of the region are of Pleistocene or recent age. The keys from Virginia Key at the north to Bahia Honda are elongated in a curve from northeast to southwest. Then follows the second group of keys including the Pine Keys, and extending to Boca Grande west of Key West are elongated in a direction at right angles to the axis of elongation of the more northerly keys; while the Marquesas and the Dry Tortugas are of atoll form. In composition the keys opposite the northern end of Bay Biscayne have a surface largely of siliceous sand. Those from Soldiers Key to the southern end of Big Pine Key are composed of elevated coral-reef rock—the Key Largo limestone. The keys from the Pine Keys

to Boca Grande are composed of an oolitic limestone—the Key West oolite, which has been so recently elevated above sea-level that its upper surface still shows sun-cracks. The Marquesas and the Tortugas keys are composed of the comminuted, calcareous tests of organisms.

The geologic activity of mangroves in converting shallow submarine banks into land areas was described and illustrated by lantern slide photographs. The fruit of these plants, which is a pod about six to nine inches long, falls into the water and catches on the soft ooze of shallow banks, where the young plants begin to grow, and after developing a tangle of roots below and a tangle of branches above the level of the water, catch and retain any drifting débris.

The speaker then pointed out how fossil corals were utilized in ascertaining the depth and temperature conditions under which geologic formations containing the remains of these organisms were deposited. The restriction of reef-forming corals to shallow water and regions of high temperature, and the existence of a different fauna at depths below 100 fathoms and in regions of cooler temperature, were pointed out.

Dr. Vaughan then briefly outlined the study of the Florida corals, which he is conducting under the auspices of the Carnegie Institution of Washington, with reference to various factors that determine habitat and influence variation. He showed that within the shallow water area of southern Florida there are several different faunal groups of corals that live under different conditions. There are the reef corals proper, largely of massive type, that grow on the barrier reef. Other corals, either of more fragile form of growth with a weaker basal attachment, or with ability to withstand deposits of silt over their upper surface, live on the flats protected from ocean breakers. Other corals of a fragile habit of growth live in channels where they have a continuous supply of pure water and are protected from the breakers. More fragile corals grow at the outer foot of a reef beneath the level of the pounding of the breakers than on the reef proper. The forms that grow at the outer foot of the reef are to some extent similar to those that grow in the channels or along the margin of channels protected from the pounding of the breakers.

The subject of the rate of growth of corals was briefly reviewed and the results of the investigations of Professor J. Stanley Gardiner in the Maldive Islands were given. Professor Gardiner there obtained a collection of corals none of which could have been more than three years of age, and on the basis of these observations estimated that the coral reef might increase one fathom in sixty years. The observations of Gardiner are weak in that he did not definitely know the age of the individual specimens he obtained.

Dr. Vaughan has at present about 200 different coral colonies on which he is making annual measurements to determine the growth rate. The colonies comprise the various conditions under which shallow-water corals grow around the Tortugas, so that the investigations when completed will give the growth rate for each species investigated, and the variation in growth of each species in accordance with the conditions under which it lives in nature. The results of the observations at present indicate that the rate of growth of corals is much more rapid than was previously anticipated, so that in a general way the opinions of Professor Gardiner are substantiated.

The technique of obtaining specimens for planting was briefly described. Besides those colonies that are naturally growing on the reefs or in other localities a number of specimens have been affixed by hydraulic cement to tiles, and the tiles have been planted on the heads of iron stakes driven in selected localities. The tiles can be removed from the stakes, measured and photographed at desired intervals.

Dr. Vaughan also described the technique of rearing coral larvæ and the planting of the affixed young. The larvæ are obtained from living corals brought into the laboratory and kept in jars of water. The planulæ are then pipetted into a jar containing sea-water and a tile on its bottom. After the planulæ have settled the tile is then planted. Some of the tiles with attached larvæ were affixed to iron stakes in the sea and others were attached to the bottom of a floating livecar. It has been ascertained that a *Favia* planula may attain a size of 9 mm. in diameter within a period of seven months.

The duration of the free-swimming larval stage of corals has been carefully studied in order to ascertain the possibilities of drift by ocean currents. The period varies from three or four days to three weeks—periods of ten to twelve days are common. These observations have definitely shown that it is possible for coral larvæ to be drifted great distances by oceanic currents if the temperature conditions are favorable.

D. E. Lantz,
Recording Secretary

April, 1911